

NASA SP-7011 (359)

February 1992

P. 60

# AEROSPACE MEDICINE AND BIOLOGY

(NASA-SP-7011(359)) AEROSPACE MEDICINE AND  
BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH  
INDEXES (SUPPLEMENT 359) (NASA) 60 p

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A CONTINUING BIBLIOGRAPHY WITH INDEXES



NASA SP-7011 (359)

February 1992

# **AEROSPACE MEDICINE AND BIOLOGY**

A CONTINUING BIBLIOGRAPHY WITH INDEXES



National Aeronautics and Space Administration  
Scientific and Technical Information Program  
Washington, DC

1992

# INTRODUCTION

This issue of *Aerospace Medicine and Biology* (NASA SP-7011) lists 164 reports, articles and other documents originally announced in January 1992 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*. The first issue of *Aerospace Medicine and Biology* was published in July 1964.

Accession numbers cited in this issue are:

STAR (N-10000 Series)	N92-10001 — N92-11965
IAA (A-10000 Series)	A92-10001 — A92-13248

In its subject coverage, *Aerospace Medicine and Biology* concentrates on the biological, physiological, psychological, and environmental effects to which humans are subjected during and following simulated or actual flight in the Earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Applied research receives the most emphasis, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion.

Each entry in the publication consists of a standard bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged by *STAR* categories 51 through 55, the Life Sciences division. The citations include the original accession numbers from the respective announcement journals.

Seven indexes—subject, personal author, corporate source, foreign technology, contract, report number, and accession number—are included.

A cumulative index for 1992 will be published in early 1993.

Information on availability of documents listed, addresses of organizations, and NTIS price schedules are located at the back of this issue.

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## TYPICAL REPORT CITATION AND ABSTRACT

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ON MICROFICHE

↓

ACCESSION NUMBER → **N92-11637\*#** Vanderbilt Univ., Nashville, TN. Dept. of Electrical Engineering. ← CORPORATE SOURCE

TITLE → **ROBOT GRAPHIC SIMULATION TESTBED Final Report**

AUTHORS → **GEORGE E. COOK, JANOS SZTIPANOVITS, CSABA BIEGL, GABOR KARSAI, and JAMES F. SPRINGFIELD** Aug. 1991 ← PUBLICATION DATE

CONTRACT NUMBER → (Contract NAG8-690) ← AVAILABILITY SOURCE

REPORT NUMBERS → (NASA-CR-188998; NAS 1.26:188998) Avail: NTIS HC/MF A06; ← PRICE CODE

12 functional color pages CSCL 06/11 ← COSATI CODE

The objective of this research was twofold. First, the basic capabilities of ROBOSIM (graphical simulation system) were improved and extended by taking advantage of advanced graphic workstation technology and artificial intelligence programming techniques. Second, the scope of the graphic simulation testbed was extended to include general problems of Space Station automation. Hardware support for 3-D graphics and high processing performance make high resolution solid modeling, collision detection, and simulation of structural dynamics computationally feasible. The Space Station is a complex system with many interacting subsystems. Design and testing of automation concepts demand modeling of the affected processes, their interactions, and that of the proposed control systems. The automation testbed was designed to facilitate studies in Space Station automation concepts.

Author

## TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT

ACCESSION NUMBER → **A92-10353**

TITLE → **EFFECTS OF HYPOXIA AND COLD ACCLIMATION ON THERMOREGULATION IN THE RAT**

AUTHORS → **H. GAUTIER, M. BONORA, S. B. M'BAREK, and J. D. SINCLAIR** (Paris VI, Universite, France; Auckland, University, New Zealand) ← AUTHORS' AFFILIATION

JOURNAL TITLE → **Journal of Applied Physiology** (ISSN 0161-7567), vol. 71, Oct. 1991, p. 1355-1363. Research supported by Institut National de la Sante et de la Recherche Medicale. refs ← PUBLICATION DATE

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Results are reported from an experimental study tracing the effects of hypoxia on thermoregulation and on the different sources of thermogenesis in rats before and after periods of 1-4 wk of cold acclimation. Measurements of the metabolic rate (VO<sub>2</sub>) and body temperature (T<sub>b</sub>) were made at 5-min intervals, and shivering activity was recorded continuously in groups of rats subjected to three protocols. Recordings were made in normoxia and in hypoxia on different days in the same animals. The results show that: (1) in noncold-acclimated (NCA) rats, cold exposure induced increases in VO<sub>2</sub> and shivering that were proportional to the decrease in T<sub>a</sub>; (2) in cold-acclimated (CA) rats in normoxia, for a given ambient temperature, VO<sub>2</sub> and T<sub>b</sub> were higher than in NCA rats, whereas shivering was generally lower; and (3) in both NCA and CA rats, hypoxia induced a transient decrease in shivering and a sustained decrease in nonshivering thermogenesis associated with a marked decrease in T<sub>b</sub> that was about the same in NCA and CA rats. It is concluded that hypoxia acts on T<sub>b</sub> control to produce a general inhibition of thermogenesis.

P.D.

# AEROSPACE MEDICINE AND BIOLOGY

*A Continuing Bibliography (Suppl. 359)*

February 1992

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## LIFE SCIENCES (GENERAL)

A92-10353

### EFFECTS OF HYPOXIA AND COLD ACCLIMATION ON THERMOREGULATION IN THE RAT

H. GAUTIER, M. BONORA, S. B. M'BAREK, and J. D. SINCLAIR  
(Paris VI, Université, France; Auckland, University, New Zealand)  
*Journal of Applied Physiology* (ISSN 0161-7567), vol. 71, Oct. 1991,  
p. 1355-1363. Research supported by Institut National de la Santé  
et de la Recherche Médicale. refs  
Copyright

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A92-10354

### CEREBRAL METABOLIC AND PRESSURE-FLOW RESPONSES DURING SUSTAINED HYPOXIA IN AWAKE SHEEP

J. IWAMOTO, D. C. CURRAN-EVERETT, E. KRASNEY, and J. A. KRASNEY (New York, State University, Buffalo) *Journal of Applied Physiology* (ISSN 0161-7567), vol. 71, Oct. 1991, p. 1447-1453. refs

(Contract NIH-1-R01-HL-36126)

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Results are presented of experiments performed to clarify the nature of the cerebral blood flow (CBF), cerebral metabolic, and cerebral venous pressure responses that occur at the onset of sustained hypoxia in conscious adult sheep. Striking early increments of CBF and decrements of cerebral vascular resistance (CVR) in association with an early temporary elevation of cerebral O<sub>2</sub> consumption were shown. After 2 h, CMRO<sub>2</sub> returned to normoxic levels, while CBF declined to a lower but still elevated level (+150 percent). CBF/CMRO<sub>2</sub> increased twofold, while cerebral fractional extraction of O<sub>2</sub> was unchanged. Mean arterial pressure was unchanged, but cerebral venous pressure rose (+11 mmHg) in a stable fashion such that cerebral perfusion pressure declined by 13 percent. Cerebral venous hematocrit and hemoglobin concentration were both elevated above the

corresponding arterial values between 150 and 210 min of hypoxia, suggesting venous hemoconcentration in possible association with transcapillary fluid shift. P.D.

A92-12225

### A NEW FINDING IN THE BAIKAL ENVIRONMENT - A BIOCOMMUNITY BASED ON BACTERIAL CHEMOSYNTHESIS [NOVOE V PRIRODE BAIKALA - SOOBSHCHESTVO, OSNOVANNOE NA BAKTERIAL'NOM KHEMOSINTEZE]

A. P. KUZNETSOV, V. P. STRIZHOV, V. S. KUZIN, V. A. FIALKOV, and V. S. IASTREBOV (AN SSSR, Institut Okeanologii, Moscow, USSR) *Akademii Nauk SSSR, Izvestiia, Seriya Biologicheskaiia* (ISSN 0002-3329), Sept.-Oct. 1991, p. 766-772. In Russian. refs  
Copyright

The paper describes a newly discovered chemosynthesis-based symbiotic community on the Lake Baikal bottom. The biocommunity includes very dense populations of sponges, Amphipodae, planarians, fishes, and other animals as well as mats of bacteria covering large bottom areas. This biocommunity is analogous to oceanic bottom communities developing near cold (seeping) and hydrothermal springs. Chemical data collected in the area suggest that the symbiosis is based on the use of biogenic methane-methanotrophic bacteria. I.S.

A92-13040

### SUDDEN EXTINCTION OF THE DINOSAURS - LATEST CRETACEOUS, UPPER GREAT PLAINS, U.S.A

PETER M. SHEEHAN (Milwaukee Public Museum, WI), DAVID E. FASTOVSKY (Rhode Island, University, Kingston), RAYMOND G. HOFFMANN (Wisconsin, Medical College, Milwaukee), CLAUDIA B. BERGHAUS (Wisconsin, University, Madison), and DIANE L. GABRIEL (Montana State University, Bozeman) *Science* (ISSN 0036-8075), vol. 254, Nov. 8, 1991, p. 835-839. Research supported by University of Rhode Island, Marquette Electronics Foundation, Igloo Corp., et al. refs

Copyright

Results of a three-year field study of family-level patterns of ecological diversity of dinosaurs in the Hell Creek Formation of Montana and North Dakota show no evidence of a gradual decline of dinosaurs at the end of the Cretaceous. Stratigraphic reliability was maintained through a tripartite division of the Hell Creek, and preservational biases were corrected for by comparison of results only from similar facies as well as through the use of large-scale, statistically rigorous survey and collection procedures. The findings are in agreement with an abrupt extinction event such as one caused by an asteroid impact. Author

A92-13242\* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.

### EVOLUTION OF BIOCONVECTIVE PATTERNS IN VARIABLE GRAVITY

DAVID A. NOEVER (NASA, Marshall Space Flight Center; Universities Space Research Association, Huntsville, AL) *Physical Review A* (ISSN 1050-2947), vol. 44, Oct. 15, 1991, p. 5279-5291. refs

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Measurements are reported of the evolution of bioconvective patterns in shallow, dense cultures of microorganisms subjected to varying gravity. Various statistical properties of this random, quasi-two-dimensional structure have been found: Aboav's law is

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obeyed, the average vertex angles follow predictions for regular polygons, and the area of a pattern varies linearly with its number of sides. As gravity varies between 1 g and 1.8 g, these statistical properties continue to hold despite a tripling of the number of polygons and a reduced average polygon dimension by a third. This work compares with experiments on soap foams, Langmuir monolayer foams, metal grains, and simulations. Author

**N92-10276#** California Univ., Davis.

### **PAUCITY OF MODERATELY REPETITIVE SEQUENCES**

C. W. SCHMID 1991 3 p

(Contract DE-FG03-88ER-60693)

(DE91-017953; DOE/ER-60693/T1) Avail: NTIS HC/MF A01

We examined clones of renatured repetitive human DNA to find novel repetitive DNAs. After eliminating known repeats, the remaining clones were subjected to sequence analysis. These clones also corresponded to known repeats, but with greater sequence diversity. This indicates that either these libraries were depleted of short interspersed repeats in construction, or these repeats are much less prevalent in the human genome than is indicated by data from *Xenopus* or sea urchin DNA studies. We directly investigated the sequence composition of human DNA through traditional renaturation techniques with the goal of estimating the limits of abundance of repetitive sequence classes in human DNA. Our results sharply limit the maximum possible abundance to 1 to 2 percent of the human genome. Our estimate, minus the known repeats in this fraction, leaves about 1 percent ( $3 \times 10^6$  (exp 7) nucleotides) of the human genome for novel repetitive elements. DOE

**N92-11610#** Joint Publications Research Service, Arlington, VA.  
**JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES**

28 Jun. 1991 29 p

(JPRS-ULS-91-015) Avail: NTIS HC/MF A03

Translations are presented of articles from various Russian periodicals. The presentation is divided into the following general categories: agricultural science; biotechnology; epidemiology; genetics; medicine; microbiology; physiology; public health; radiation biology; and virology. Some representative titles might be: Plasticity and Resistance of Barley to Root Rot; Biosynthetic Activity of Wood Destroying Basidiomycetes in Submerged Culture; Drug Resistance and Plasmid Profiles of DNA of *Shigella dysenteriae* 1 in the USSR and Abroad; Creation of an Integrative Expression Vector and its Use for Introduction of the Recombinant Human Alpha Interferon Gene into Plants; Current Burns Management in Disaster Medicine; Mechanism of Resistance of Methicillin Resistant *Staphylococcus aureus* to Phages of the International Collection; Visual Perception Training and Changes in Autonomic and Psychophysiological Indicators; Epidemiology of Cerebrovascular Disease in USSR; and Pharmacokinetics of Inhaled Pu-238 Tributyl Phosphate Complex. E.R.

**N92-11611#** Joint Publications Research Service, Arlington, VA.  
**JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES**

3 Jun. 1991 48 p

(JPRS-ULS-91-012) Avail: NTIS HC/MF A03

Translations of articles from various Russian publications are presented in the Life Sciences category. The presentation is divided into the following general topic areas: microbiology; military medicine; molecular biology; pharmacology, toxicology; physiology; and public health. Some representative titles might be: Study of Induction of Tumor Necrosis Factor and Interleukin-1 with use of Glycopolymers Isolated from *Pseudomonas solanacearum* and *Clavibacter michiganense*; Lab Assessment of Quality and Standardization of New Plasma Replacing Protein Saline Solution 'Protesalin' for Shock Therapy; Directed Reconstruction of Influenza Virus Hemagglutinin Gene; Effect of Delta-9 Tetrahydro cannabinol on Receptor and Physicochemical Properties of Rat Cerebral Membranes; Effect of Enkephalins on Associative Processes in Parietal Cortex Neurons; and Work of Belorussian Radiation Medicine Institute Described. E.R.

**N92-11612#** Illinois Univ., Urbana. Dept. of Chemistry.

### **BIOCHEMICAL AND BIOPHYSICAL STUDIES OF THE E. COLI RESPIRATORY CHAIN**

R. B. GENNIS 1991 20 p

(Contract DE-FG02-87ER-13716)

(DE91-016966; DOE/ER-13716/2) Avail: NTIS HC/MF A03

*Escherichia coli* contains two distinct ubiquinol oxidases but no cytochrome c-dependent branch of its aerobic respiratory chain. The cytochrome d complex has a very high affinity for molecular oxygen and is the predominant oxidase when the cells are grown with limited oxygen. The cytochrome o complex is the predominant oxidase present when *E. coli* is grown at high aeration. This grant is directed towards characterizing the cytochrome o complex. Substantial progress has been made during the past five years. The single most important results of our work is the demonstration that the *E. coli* cytochrome o complex is closely related structurally to the family of mitochondrial and bacterial aa(sub 3)-type cytochrome c oxidases. This has revealed the existence of a superfamily of proton-pumping respiratory oxidases that share common structural and mechanistic features, but vary with respect to substrate (cytochrome c vs quinol) and/or heme components (a-type vs protoheme). DOE

**N92-11613#** Yale Univ., New Haven, CT. Dept. of Psychology.  
**LONG TERM SYNAPTIC PLASTICITY AND LEARNING IN NEURONAL NETWORKS Final Annual Report, 1 Oct. 1988 - 30 Sep. 1991**

THOMAS H. BROWN 5 Aug. 1991 12 p

(Contract AF-AFOSR-0047-89; AF PROJ. 2312)

(AD-A240366; AFOSR-91-0727TR) Avail: NTIS HC/MF A03

CSCL 05/2

The purpose of this project was to understand a form of synaptic plasticity, called long-term potentiation (LTP), that appears to be a good candidate mechanism for rapid learning in mammals. LTP is a persistent form of synaptic enhancement that can be rapidly induced by brief periods of stimulation. As this project evolved, I focused on four aims: (1) methods for studying mechanisms underlying LTP expression in the hippocampus; (2) using these methods to elucidate the mechanisms; (3) developing a suitable system for evaluating the role of LTP in learning; (4) developing and applying methods of computational neuroscience to create a learning theory that is grounded in principles of cellular neurophysiology. GRA

**N92-11614#** Murcia Univ. (Spain).

### **THE 4TH INTERNATIONAL WORKSHOP ON MEMBRANE BIOTECHNOLOGY AND MEMBRANE DIOMATERIALS**

2 Jun. 1991 79 p Workshop held in La Manga, Murcia, Spain, 29 May - 2 Jun. 1991

(Contract DAJA45-90-M-0034)

(AD-A240481; R/D-6606-BC-02) Avail: NTIS HC/MF A05

CSCL 06/5

This talk describes recent basic studies of polypeptides and proteins using Fourier Transfer Infrared (FTIR) spectroscopic techniques. Signal polypeptides, water soluble and membrane proteins were studied. The qualitative and quantitative information which can be deduced concerning secondary structure will be shown. The possibility of distinguishing a normal alpha-helical structure from a helical structure by this technique will be indicated. Recent technological studies of blood coagulation behaviour in the presence of various lipid polar surfaces, including negative charges, positive charges and Zwitter-ion charges will be described. GRA

**N92-11615#** Los Alamos National Lab., NM.

### **BIOLOGICAL EFFECTS OF MINERALS**

G. D. GUTHRIE, JR. Sep. 1991 46 p

(Contract W-7405-ENG-36)

(DE91-018183; LA-12184-MS) Avail: NTIS HC/MF A03

In general, clay materials exhibit a range of biological activities, from apparently inactive or slightly active, such as hematite, to highly fibrogenic and carcinogenic, such as fibrous brucite (nematite). The zeolites also exhibit such a range, with some

mordenite being slightly active and erionite being highly active; however, erionite is the only zeolite that has been studied extensively. The diversity of mineral species holds great potential for probing these mechanisms, especially when mineralogical data are integrated with biological data. Unfortunately, many of the studies reporting data on the biological effects of clays and zeolites fail to report detailed mineralogical information; hence, it is difficult at present to interpret the biological activities of minerals in terms of their physical and chemical properties. Important mineralogical data that are only rarely considered in biological research include exact mineralogy of the specimen (i.e., identification and abundance of contaminants), physical and chemical properties of minerals, and surface properties of minerals. DOE

## 52

## AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

## A92-10351

## CORE TEMPERATURE 'NULL ZONE'

IGOR B. MEKJAVIC, CARL J. SUNDERG, and DAG LINNARSSON (Karolinska Institutet, Stockholm, Sweden) *Journal of Applied Physiology* (ISSN 0161-7567), vol. 71, Oct. 1991, p. 1289-1295. Research supported by AGA, AB, NSERC, and Ragvald Foundation. refs Copyright

The present study examines an experimental protocol designed to investigate whether human core temperature is regulated at a 'set point' or whether there is a neutral zone between the core thresholds for shivering thermogenesis and sweating. Nine male subjects exercised on an underwater cycle ergometer at a work rate equivalent to 50 percent of their maximum work rate. On completion of the exercise, the rate of forehead sweating decayed from a mean peak value of  $7.7 \pm 4.2$  (SD) to  $0.6 \pm 0.3$  g/sq m min, which corresponds to the rate of passive transpiration, at core temperatures of  $37.42 \pm 0.29$  and  $37.39 \pm 0.48$  C, as measured in the esophagus and rectum, respectively. The results indicate that the core temperatures at which sweating ceases and shivering commences are significantly different (less than 0.001), regardless of whether core temperature is measured within the esophagus or rectum. This further confirms the existence of a thermoregulatory 'null zone' between the threshold core temperatures for shivering thermogenesis and sweating. P.D.

## A92-10352

## EFFECTS OF MUSCLE GLYCOGEN AND PLASMA FFA AVAILABILITY ON HUMAN METABOLIC RESPONSES IN COLD WATER

LUCIE MARTINEAU and IRA JACOBS (Defence and Civil Institute of Environmental Medicine, North York; Toronto, University, Canada) *Journal of Applied Physiology* (ISSN 0161-7567), vol. 71, Oct. 1991, p. 1331-1339. Research supported by DND. refs Copyright

## A92-10355

## INTERNAL CAROTID FLOW VELOCITY WITH EXERCISE BEFORE AND AFTER ACCLIMATIZATION TO 4,300 M

S. Y. HUANG, K. W. TAWNEY, P. R. BENDER, B. M. GROVES, R. E. MCCULLOUGH, R. G. MCCULLOUGH, A. J. MICCO, M. MANCO-JOHNSON, A. CYMERMAN, E. R. GREENE (Colorado, University, Denver; U.S. Army, Institute of Environmental Medicine, Natick, MA; Lovelace Medical Foundation, Albuquerque, NM; Shanghai Institute of Physiology, People's Republic of China) et al. *Journal of Applied Physiology* (ISSN 0161-7567), vol. 71, Oct. 1991, p. 1469-1476. refs (Contract NIH-HL-14985) Copyright

Doppler ultrasound was used to measure the internal carotid artery flow velocity at sea level, on arrival, and after 3 wk of acclimatization on Pikes Peak, CO, at 4300 m. The exercise responses were examined for both brief and sustained exercise due to the different hemodynamic and blood-gas changes for the two types of exercise. Although at sea level the increase in cerebral flow with exercise is relatively independent of exercise intensity, no reports of cerebral blood flow (CBF) with prolonged exercise at constant intensity either at sea level or at altitude were found. Exercise measurements of CBF at high altitude are potentially important because PCO<sub>2</sub> fell on arrival, arterial O<sub>2</sub> saturation fell with exercise both on arrival and after acclimatization, and maintenance of cerebral O<sub>2</sub> delivery had significant implications for well-being at altitude. P.D.

## A92-11250

## ALTITUDE DECOMPRESSION SICKNESS - A REVIEW

ROBERT A. MITCHELL and ROBERT MONTGOMERY, III (Aeromedical and Training Digest, vol. 5, Oct. 1991, 3 p. refs Copyright

A study of the cause and resultant symptoms and effects of altitude decompression is presented. The symptoms produced by decompression sickness (DCS) are the measure used in the classification of the disorder, type 1 is characterized by skin manifestations or limb bends, while type 2 generally consists of neurological dysfunction. Consideration is given to the treatment of DCS by prompt recompression in a hyperbaric chamber. Attention is given to procedures for preventing DCS in flight operations. R.E.P.

## A92-11473

## PREDICTION OF HELICOPTER SIMULATOR SICKNESS

ROGER D. HORN, J. D. BIRDWELL (Tennessee, University, Knoxville), and GLENN O. ALLGOOD (Oak Ridge National Laboratory, TN) IN: IEEE Conference on Decision and Control, 29th, Honolulu, HI, Dec. 5-7, 1990, *Proceedings*. Vol. 4, New York, Institute of Electrical and Electronics Engineers, Inc., 1990, p. 2380-2385. Research supported by Oak Ridge National Laboratory. Previously announced in STAR as N91-14710. refs (Contract NSF ECS-87-15092; DE-AC05-84OR-21400) Copyright

Machine learning methods from artificial intelligence are used to identify information in sampled accelerometer signals and associative behavioral patterns which correlate pilot simulator sickness with helicopter simulator dynamics. In this work, accelerometers were installed in the simulator cab, enabling a complete record of the flight dynamics and the pilot's control response as a function of time. When given the results of performance measures administered to detect simulator sickness symptoms, the problem was to find functions of the recorded data which could be used to help predict the simulator sickness level and susceptibility. Methods based upon inductive inference were used, which yield decision trees whose leaves indicate the degree of simulator-induced sickness. The long-term goal is to develop a 'gauge' which can provide an online prediction of simulator sickness level when given a pilot's associative behavioral patterns (learned expectations). This will allow informed decisions to be made on when to terminate a hop and provide an effective basis for determining the training and flight restrictions to be placed upon the pilot after simulator use. Author

## A92-12125

## ANALOGY BETWEEN TRAINING FOR DANCERS AND PROBLEMS OF ADJUSTMENT TO MICROGRAVITY - AN EVALUATION OF THE SUBJECTIVE VERTICAL IN DANCERS

KITSOU DUBOIS (IAF, International Astronautical Congress, 41st, Dresden, Federal Republic of Germany, Oct. 8-12, 1990) *Acta Astronautica* (ISSN 0094-5765), vol. 25, Aug.-Sept. 1991, p. 605-613. refs (IAF PAPER 90-653) Copyright

Research intended to evaluate the subjective vertical of dancers was carried out with reference to Mittelstaedt's observations on the proportional relationship between space sickness and some

astronauts' poor evaluation of the subjective vertical. The qualities of body awareness and specific motricity in dancers imply balance, coordination, muscular performance, and perfect orientation, problems that astronauts also encounter in microgravity. O.G.

### A92-13197

#### LUNG AND CHEST WALL MECHANICS IN MICROGRAVITY

J. EDYVEAN, M. ESTENNE, M. PAIVA, and L. A. ENGEL (Westmead Hospital, Sydney, Australia; Erasmus Hospital; Bruxelles, Université Libre, Brussels, Belgium) Journal of Applied Physiology (ISSN 8750-7587), vol. 71, Nov. 1991, p. 1956-1966. Research supported by National Health and Medical Research Council of Australia, Ministère de la Politique Scientifique and Conseil National de la Politique Scientifique of Belgium. refs Copyright

The effects of 15-20 s of weightlessness on lung, chest wall, and abdominal mechanics were investigated in five normal subjects inside an aircraft flying repeated parabolic trajectories. Flow at the mouth, thoracoabdominal and compartmental volume changes, and gastric pressure (Pga) were measured. In two subjects, esophageal pressures were measured as well, allowing for estimates of transdiaphragmatic pressure (Pdi). In all subjects functional residual capacity at 0 Gz decreased by  $244 \pm 31$  ml as a result of the inward displacement of the abdomen. There was no consistent effect of Gz on the tidal swings of Pdi, on pulmonary resistance and dynamic compliance, or on any of the timing parameters determining the temporal pattern of breathing. The results indicate that at 0 G respiratory mechanics are intermediate between those in the upright and supine postures at 1G. Analysis of end-expiratory pressures suggests that during weightlessness intraabdominal pressure is zero, the diaphragm is passively tensed, and a residual small pleural pressure gradient may be present. C.A.B.

**N92-10277** Institute for Perception RVO-TNO, Soesterberg (Netherlands). Thermophysiology Group.

#### PHYSIOLOGICAL RESPONSES OF THE HUMAN EXTREMITIES TO COLD WATER IMMERSION Final Report

H. A. M. DAANEN and M. B. DUCHARME (Defence and Civil Inst. of Environmental Medicine, North York, Ontario) 5 Apr. 1991 31 p

(Contract A87/M/124)

(IZF-1991-A-15; TD-91-0044; ETN-91-99992) Copyright Avail: Institute for Perception RVO-TNO, P.O. Box 23, 3769 ZG Soesterberg, Kampweg 45, Netherlands

Five subjects immersed their hands and feet twice during 1 hour sessions in a calorimeter bath, filled with water at 25 C. Before immersion the hand ( $33.0 \pm 2.2$  C) was warmer than the foot ( $30.6 \pm 2.1$  C) and so was the blood flow: respectively  $5.8 \pm 0.7$  versus  $0.7 \pm 0.3$  ml/min.100 ml/tissue) as determined by strain gauge plethysmography and  $10.8 \pm 5.1$  versus  $6.7 \pm 5.3$  by the doppler method. At the end of the immersion period the blood flow had decreased a factor of 2.9 (doppler) and 4.3 (plethysmography). The local heat transfer, determined by heat flux transducers, was highest immediately after immersion. The maximum was higher at the ventral sides than at the dorsal sides of the hand ( $225 \pm 93$  versus  $186 \pm 61$  W./sq m) and the foot ( $178 \pm 53$  versus  $160 \pm 57$  W./sq m). The total heat transferred to the water by hand or foot during the 60 minutes of immersion, determined by calorimetry, was  $47 \pm 21$  and  $36 \pm 18$  kJ respectively and was not statistically different due to considerable interindividual differences. Interindividual differences were also found for heat flux, rectal and local skin temperature and blood flow. These differences will have to be taken into account if a comparison is made with data from subjects with local cold injuries. ESA

**N92-10278#** Hebrew Univ., Jerusalem (Israel). Laser Center. FUNDAMENTAL STUDIES IN THE MOLECULAR BASIS OF LASER INDUCED RETINAL DAMAGE Final Report, 1 Nov. 1987 - 31 Oct. 1990

AARON LEWIS 15 Apr. 1991 23 p

(Contract DAMD17-88-Z-8008; DA PROJ. 3M1-62787-A-878) (AD-A239941) Avail: NTIS HC/MF A03 CSCL 06/5

The past three years has seen considerable advancements in our understanding of the fundamental basis of laser interaction with retinal and ocular tissue. In this section we will review our achievements during the past three years of support by the Ocular Hazards Program of the United States Letterman Army Institute of Research. This support has resulted in 15 published papers. These papers have reported for the first time second harmonic generation in rhodopsin. The data provide an understanding of the very efficient second harmonic generation that is occurring in visual pigments. The fundamental understanding that we have obtained begins to elucidate the interactions that could underlie the psychophysical phenomena that have been indicated green sensation with Nd:YAG laser illumination. In addition, these results are leading to a more detailed understanding of the photodynamics of the rhodopsin spectral alterations under both one and two photon illumination. This photodynamics is the basic information that is required in order to design the constraints that must be met in order to develop photodynamic filters. GRA

**N92-10279#** Letterman Army Inst. of Research, San Francisco, CA.

#### TWO INFORMATIVE CASES OF Q-SWITCHED LASER EYE INJURY Institute Report, Jul. 1989 - Jul. 1991

H. ZWICK, B. E. STUCK, D. GAGLIANO, V. C. PARMLEY, and J. LUND Jul. 1991 26 p

(AD-A240001; LAIR-IR-463) Avail: NTIS HC/MF A03 CSCL 06/5

We describe two cases of parafoveal Q-switched laser retinal injuries which illustrate the variability of the processes set in motion by retinal laser injuries. The first case demonstrates that parafoveal lesions may cause an immediate degradation in visual functions which may recover spontaneously to almost normal levels. In the second, multiple parafoveal exposure sites produced central retinal scars at the parafoveal lesion sites and resulted in retinal traction over an extensive region of the retina with local retinal hole formation at the edge of the central scar. A central arcuate absolute scotoma appeared shortly after exposure. The central scotoma, as well as visual acuity, stationary and dynamic contrast sensitivity functions were permanently altered. No treatment presently exists to alleviate or minimize the effects of this retinal scarring process. GRA

**N92-10280#** Northwestern Univ., Evanston, IL.

#### PROGRAM AND ABSTRACTS OF THE 2ND MEETING OF THE SOCIETY FOR RESEARCH ON BIOLOGICAL RHYTHMS Final Report, 1 May 1990 - 30 Apr. 1991

FRED W. TUREK 15 Jul. 1991 121 p Meeting held in Jacksonville, FL, 9-13 May 1990

(Contract AF-AFOSR-0270-90; AF PROJ. 2312)

(AD-A240007; AFOSR-91-0725TR) Avail: NTIS HC/MF A06 CSCL 06/4

From May 9-13, 1990 the Society for Research on Biological Rhythms held its second meeting at Amelia Island Plantation, Florida. The Society was formed to promote the advancement of basic and applied research in all aspects of biological rhythms, to disseminate important research results concerning biological rhythms to the general public, to develop and enhance the education and training of students and researchers in the field and to foster interdisciplinary communication. This second meeting was successful in meeting the goals of the Society, particularly in the area of interdisciplinary communication. This second meeting promoted the interaction of workers in the various areas in a variety of different ways. First, there was a mixture of Symposia as well as slide and poster sessions on clinical and basic research topics. The Symposia were organized to insure that the entire frequency range of biological rhythms would be presented. GRA

**N92-10281#** University of Southern Mississippi, Hattiesburg. AUDITORY AND VISUAL EVOKED POTENTIALS AS A FUNCTION OF SLEEP DEPRIVATION AND IRREGULAR SLEEP Final Report

JOHN R. HARSH 30 Apr. 1991 172 p  
(Contract DAMD17-88-C-8016; DA PROJ. 3E1-62777-A-879)  
(AD-A240097) Avail: NTIS HC/MF A08 CSCL 06/10

This report describes progress in a program of research concerned with whether event-related brain potentials (ERPs) provide a reliable, valid, and practical way of predicting performance. Two objectives of the program were to develop the capacity to measure, analyze, and interpret ERPs and to demonstrate that ERPs are sensitive to factors influencing performance. Experiments are described that show ERP variation in studies of orienting responses, habituation, and Pavlovian conditioning. Additional experiments show ERP changes in relation to time-of-day and ultradian variation in performance. Several experiments describe the relationship between ERP and performance changes during the wake/sleep transition. These experiments encourage the view that ERPs are closely related to both arousal and cognitive factors influencing performance. GRA

**N92-10539#** Kuopio Univ. (Finland). Dept. of Applied Physics.  
**SPECTRAL REPRESENTATION IN VISION Abstract Only**  
J. HALLIKAINEN, J. PARKKINEN, and T. JAASKELAINEN *In* Oulu Univ., Proceedings of the 25th Annual Conference of the Finnish Physical Society 1 p 1991 Sponsored by Academy of Finland  
Avail: NTIS HC/MF A12

A simplified color vision model is described and analyzed. The Principal Component Analysis (PCA) is used to find out the spectral information content of the model. Instead of traditional calorimetry, the human color vision and physical color measurements are compared more directly. This can be done by comparing the spectral information content of the Munsell color chips, natural color samples, physiological data measured from the macaque monkey and a simplified model of human color visions. The results show clearly that there exists connections between the color subspace representations derived from the PCA and human color vision models. The subspace representation of colors was shown to be an effective tool to compress information, without significant loss of the spectral information and the subspace model could also be a working hypothesis for higher level color recognition by the brain. ESA

**N92-10540#** Helsinki Univ. of Technology, Espoo (Finland). Low Temperature Lab.

**INTEGRATION OF MAGNETOENCEPHALOGRAPHY AND MAGNETIC RESONANCE IMAGING Abstract Only**

S. O. TISSARI and M. S. HAMALAINEN *In* Oulu Univ., Proceedings of the 25th Annual Conference of the Finnish Physical Society 1 p 1991  
Avail: NTIS HC/MF A12

Magnetic Resonance Imaging (MRI) data provided by the Siemens 1-Tesla MRI system at the Helsinki University Central Hospital was utilized. The coordinate systems of MRI and MEG (Magnetoencephalography) were aligned by attaching small oil filled capsules on the head's landmarks before MR imaging. Three orthogonal MRI data sets, each consisting of 20 T sub 2 and proton density weighted images, were collected at 7 to 8 mm spacing to cover the whole brain. For accurate three dimensional reconstructions, another set comprising 128 parallel slices at 1.3 to 1.5 mm spacing was obtained with a special pulse sequence enhancing the brain with respect to the surrounding tissue. The software is based on the X Window system on a UNIX workstation and, therefore, several concurrent processes can be smoothly integrated. Image viewing software allowing the inspection of the three orthogonal image sets in parallel was written. The three orthogonal slices can also be displayed in a three dimensional view to get a better perception of the relative orientation and position of the slices. The locations of the sources can be directly superimposed on the MR images. ESA

**N92-10541#** Kuopio Univ. (Finland). Dept. of Applied Physics.  
**CLUSTERING: A POWERFUL AID IN CLASSIFYING QRS WAVEFORMS Abstract Only**  
L. PATOMAKI and M. JARVILUOTO *In* Oulu Univ., Proceedings

of the 25th Annual Conference of the Finnish Physical Society 1 p 1991

Avail: NTIS HC/MF A12

A method for classifying quasi random shaker (QRS) waveforms in electrocardiography (ECG) using two different methods in parallel was developed. The A classification was based on the width, height, area and RR intervals of QRS waveforms. The B classification was, on the other hand, based on the clustering of the waveforms by their morphology. The B classification depends on the A classification and the B is the final one (output). Using clustering in QRS classification in this way shows two clear advantages: seldom occurring waveforms, most probably noise, are filtered out and the classification is improved through stabilizing the classification when the A classification lies on some borderline between N and V groups. ESA

**N92-10542#** Kuopio Univ. (Finland). Dept. of Applied Physics.  
**ALGORITHM FOR DETECTION OF VFIB IN REAL TIME FROM ECG Abstract Only**

L. PATOMAKI and A. NIEMINEN *In* Oulu Univ., Proceedings of the 25th Annual Conference of the Finnish Physical Society 1 p 1991  
Avail: NTIS HC/MF A12

A simple and fast algorithm for the detection of the Ventricular Fibrillation (VF) in ECG in real time was developed and tested. Depending on the first derivative of the signal, the data points are classified either to belong to a horizontal or to a vertical part of the signal. The distance of the point from the baseline is taken into account so that only those points which situate close enough to the baseline are accepted into the class of horizontal point. The second derivative is used to detect sharp peaks in the signal expected to be R waves, to avoid false positive detection of VF. ESA

**N92-10543#** Kuopio Univ. (Finland). Dept. of Applied Physics.  
**ANALYSIS OF ESOPHAGEAL PH-RECORDINGS FOR REFLUX DISEASE Abstract Only**

L. PATOMAKI, P. VAINIO, E. LANSIMIES, and K. JARVINEN *In* Oulu Univ., Proceedings of the 25th Annual Conference of the Finnish Physical Society 1 p 1991  
Avail: NTIS HC/MF A12

The five year use of a battery operated, portable and light weighted data logger and an IBM personal computer compatible software to measure and analyze pH signal for 24 hours, at every 3 seconds, was addressed. A study to find out the best way to use the results, to find the best clinically valuable threshold values in the decision making of the patients care, medication or operation, was undertaken. Preliminary results show the following data. The reflux time being more than 10 percent of the whole measurement period was with 22 percent of the patients. In none was the reflux index more than 40 percent of the measurement time. Sixty-one of the patients showed reflux time index less than 6 percent of the time. The refluxes appear mainly during the upright position and only 30 percent of patients had percentages between 1 to 36 while lying down. ESA

**N92-10545#** Oulu Univ. (Finland). Dept. of Physics.  
**PROTON NMR STUDIES ON HUMAN BLOOD PLASMA: AN APPLICATION TO CANCER RESEARCH Abstract Only**

M. ALA-KORPELA, Y. HILTUNEN, JUUKA JOKISAARI, S. ESKELINEN, and K. KIVINIITTY *In its* Proceedings of the 25th Annual Conference of the Finnish Physical Society 1 p 1991  
Avail: NTIS HC/MF A12

The use of proton NMR (Nuclear Magnetic Resonance) spectroscopy of human blood plasma for cancer research is shown to be complicated even when combined with the division of the spectral region into the components corresponding the various lipoproteins VLDL, LDL, and HDL, and with the efficient model for the analysis. However, the presented technique, which is a combination of the very informative and fast proton NMR experiments and the efficient, accurate, and adaptable lineshape fitting analysis method, can be used as a rapid research tool for

figuring out the relative concentrations of the lipoproteins in blood plasma and explaining the reasons behind the changes in the spectra. ESA

**N92-11616#** Joint Publications Research Service, Arlington, VA.  
**JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES Abstracts Only**

7 Oct. 1991 65 p Transl. into ENGLISH from various Russian articles

(JPRS-ULS-91-017) Avail: NTIS HC/MF A04

Translations from various Russian publications are presented. The areas of general interest are as follows: aerospace medicine; biophysics; biotechnology; epidemiology; immunology; microbiology; physiology; public health; radiation biology; and virology. Some titles of interest are listed as follows: Effects of Prolonged Space Flight on Erythrocyte Metabolism and Membrane Functional Condition; Efficacy of Hyperbaric Oxygenation in Enhancing Flight Tolerance; Toxicity Assessment of Combustion Products in Simulated Space Cabins; and Technical Requirements of Sick Bays Aboard Space Ships.

**N92-11617#** Joint Publications Research Service, Arlington, VA.  
**EFFECT OF PROLONGED SPACE FLIGHT ON ERYTHROCYTE METABOLISM AND MEMBRANE FUNCTIONAL CONDITION Abstract Only**

S. M. IVANOVA, S. S. BRANTOVA, O. I. LABETSKAYA, G. S. ARZAMAZOV, N. V. DELENYAN, and T. I. TURKINA *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 1 7 Oct. 1991 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 24, no. 6, Nov. - Dec. 1990 p 18-23

Avail: NTIS HC/MF A04

Erythrocyte metabolism was assessed in two cosmonauts following 326 day (cosmo 1) and 160 day (cosmo 2) space flights. Studies on day 1 after landing revealed marked depression of erythrocyte glycolysis and reduced ATP levels in both cosmonauts. On day 9, glycolysis and ATP had returned to baseline levels in cosmo 2, but continued to decline in cosmo 1. Changes in erythrocyte membranes included a significant increase in free cholesterol and cholesterol esters on day 9, while phospholipids were reduced. Furthermore, phosphatidyl ethanolamine showed a significant reduction and an increase in lysophosphatidyl choline in cosmo 1, while cardiolipin was elevated in both cosmos. Further metabolism alterations included a reduction of membrane Na(+), K(+) -ATPase and an increase in Ca(2+), Mg(2+) -ATPase activities. In addition, in the immediate post-flight period the erythrocytes displayed enhanced resistance to acid hemolysis. These observations showed that space flight conditions have a profound effect on the metabolic and physiological status of erythrocytes, resulting in reduced deformability. Accordingly, appropriate measures should be used in-flight and post-flight to insure normal erythrocyte function. Author

**N92-11618#** Joint Publications Research Service, Arlington, VA.  
**EFFICACY OF HYPERBARIC OXYGENATION IN ENHANCING FLIGHT TOLERANCE Abstract Only**

I. N. CHERNYAKOV, A. A. SHISHOV, O. A. VOROBYEV, V. I. NEKRASOV, N. F. POPOV, S. M. RAZINKIN, and A. V. SEMENOV *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 1 7 Oct. 1991 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 24, no. 6, Nov. - Dec. 1990 p 21-23

Avail: NTIS HC/MF A04

Thirty men, 19 to 48 years old, were used in an assessment of the efficacy of hyperbaric oxygenation (HO; 1 to 10 1 hr sessions at pO<sub>2</sub> = 2 atm over 10 to 12 days) in enhancing flight tolerance. Assessment of mental and physical performance demonstrated that poor altitude tolerance was improved to the extent that the maximum altitude could be increased by 1 km and reserve time at 5 to 7 km by 3 to 4 min. These improvements persisted for 2 to 3 months. In addition, subjects with average performance on statokinetic tests showed a 2 to 2.5 fold improvement following a course of HO. Finally, fatigue due to repetitive work under adverse

conditions (22 to 49 C, 92 to 95 dB noise) was alleviated by HO, in comparison with conventional 2 hr rest periods, to the degree that 15 to 20 pct. more work could be accomplished prior to the onset of intolerable fatigue. On balance, the data demonstrated that HO promotes more efficient recovery from flight related fatigue than seen with simple periods of rest and enhances high altitude tolerance. Author

**N92-11619#** Joint Publications Research Service, Arlington, VA.  
**TOXICITY ASSESSMENT OF COMBUSTION PRODUCTS IN SIMULATED SPACE CABINS Abstract Only**

V. F. USHAKOV, G. I. SOLOMIN, V. P. SAVINA, S. S. PASHIN, L. V. MARCHENKO, A. I. GORSHUNOVA, E. I. CHUKHNO, V. M. ZINOVYEV, N. YE. OSTASHEVA, YE. A. DEMCHENKO et al. *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 4 7 Oct. 1991 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina (Moscow, USSR), v. 24, no. 6, Nov. - Dec. 1990 p 58-60

Avail: NTIS HC/MF A04

The toxicity of the combustion products of polymers used in transformers was assessed on outbred albino rats and mice in simulated space cabins. Polyamide-6 and getinaks represented 81.4 pct. of the polymers in the transformer by weight. The resultant data indicated that within the testing parameters, unambiguous toxicity was lacking. It also became apparent that tests reflecting function of the nervous system are the most sensitive indicators of toxicity. Furthermore, tolerance of combustion products may be best assessed by determining the level of hepatic detoxication. The experiments also showed that within a cabin volume of 80 cu m, the concentrations of the most toxic products (hydrocyanic acid, carbon monoxide, ammonia, hydrogen fluoride, and formaldehyde) produced by a transformer fire remained below threshold limit values. Smaller cabins, accordingly, would present greater toxicity risks even on short term exposure. Author

**N92-11621\*** National Aeronautics and Space Administration.  
Langley Research Center, Hampton, VA.

**RAPIDLY QUANTIFYING THE RELATIVE DISTENTION OF A HUMAN BLADDER Patent**

JOHN A. COMPANION, inventor (to NASA), JOSEPH S. HEYMAN, inventor (to NASA), BETH A. MINEO, inventor (to NASA), ALBERT R. CAVALIER, inventor (to NASA), and TRAVIS N. BLALOCK, inventor (to NASA) 22 Oct. 1991 14 p Filed 26 May 1989 Continuation of US-Patent-Appl-SN-118993, filed 10 Nov. 1987 which is a continuation-in-part of abandoned US-Patent-Appl-SN-929869, filed 13 Nov. 1986

(NASA-CASE-LAR-13901-2; US-PATENT-5,058,591; US-PATENT-APPL-SN-358213; US-PATENT-APPL-SN-118993; US-PATENT-APPL-SN-929869; US-PATENT-CLASS-128-661.03; INT-PATENT-CLASS-A61B-8/00) Avail: US Patent and Trademark Office CSCL 06/2

A device and method was developed to rapidly quantify the relative distention of the bladder of a human subject. An ultrasonic transducer is positioned on the human subject near the bladder. A microprocessor controlled pulser excites the transducer by sending an acoustic wave into the human subject. This wave interacts with the bladder walls and is reflected back to the ultrasonic transducer where it is received, amplified, and processed by the receiver. The resulting signal is digitized by an analog to digital converter, controlled by the microprocessor again, and is stored in data memory. The software in the microprocessor determines the relative distention of the bladder as a function of the propagated ultrasonic energy. Based on programmed scientific measurements and the human subject's past history as contained in program memory, the microprocessor sends out a signal to turn on any or all of the available alarms. The alarm system includes and audible alarm, the visible alarm, the tactile alarm, and the remote wireless alarm.

Official Gazette of the U.S. Patent and Trademark Office



**N92-11622#** Michigan Univ., Ann Arbor. Div. of Nuclear Medicine.

**NON-INVASIVE EVALUATION OF THE CARDIAC AUTONOMIC NERVOUS SYSTEM BY PET**

1991 3 p

(Contract DE-FG02-90ER-61091)

(DE91-018476; DOE/ER-61091/1) Avail: NTIS HC/MF A01

Our research efforts in the first funding year concentrated on animal and clinical studies validating C-11 hydroxyephedrine as a marker for norepinephrine uptake and storage in presynaptic sympathetic nerve terminals. In addition to kinetic studies in animals, the first clinical studies have been performed. C-11 hydroxyephedrine provides excellent image quality in the human heart with high myocardium to blood ratios. A canine model with transient intracoronary occlusion of the left anterior descending aorta was used to show decreased retention of tracer with ischemia. Clinical studies of patients with acute myocardial infarction showed an area of decreased retention of tracer exceeding the infarct territory as defined by Rb-82 blood flow imaging. We are also developing tracers for the parasympathetic nervous system. It appears that methyl-TRB is a specific tracer for this system. Studies of C-11 or F-18 benzovesamicol as a potential tracer for parasympathetic presynaptic nerve terminals are under way.

DOE

**N92-11623#** National Council on Radiation Protection and Measurements, Bethesda, MD.

**DEVELOPMENT OF RECOMMENDATIONS IN THE AREA OF IONIZING RADIATIONS**

1991 9 p

(Contract DE-FG05-90ER-60951)

(DE91-018527; DOE/ER-60951/2) Avail: NTIS HC/MF A02

This semiannual progress report is for the period 10/30/90 through 8/31/91. It describes the reports, proceedings, commentary, and lectures published by the National Council on Radiation Protection (NCRP) during this period. The reports published were: influence of radiation quality (LET) on relative biological effectiveness; implementation of the principle of as low as reasonably achievable (ALARA) for medical and dental personnel; and conceptual basis for calculations of absorbed dose distributions. The NCRP Proceedings 12, health and ecological implications of radioactively contaminated environments, was published, as was NCRP Commentary 6, radon exposure of the U.S. population -- status of the problem. Taylor Lecture 14, radiation protection and the internal emitter problem, was presented at the 1990 Annual Meeting. Currently there are three reports, one Commentary and one Taylor Lecture in press.

DOE

**N92-11624#** Harvard Univ., Cambridge, MA. Dept. of Psychology.

**PET STUDIES OF COMPONENTS OF HIGH-LEVEL VISION**

**Quarterly Report**

STEPHEN M. KOSSLYN Aug. 1991 4 p

(Contract N00014-91-J-1243)

(AD-A240202) Avail: NTIS HC/MF A01 CSCL 06/4

We have finished analyzing the data from our first PET experiments and written a report of the results. As noted earlier, we have strong evidence ( $p = .0001$ ) that primary visual cortex is activated selectively during visual mental imagery. In our next PET experiment we will study how objects are identified when seen from unusual points of view. Warrington and Taylor (1973) found that patients with right-parietal lesions have a very difficult time recognizing objects seen from unusual points of view. Kosslyn, Flynn, Amsterdam and Wang (1990) explain this result by positing a top-down, hypothesis testing mechanism that is called into play when a stimulus does not immediately match a stored memory very well. This mechanism not only relies on processes in the parietal lobe to shift attention, but also on processes in the frontal lobe formulate hypotheses. To test these ideas, subjects will see a series of pictures, either of objects seen from a canonical point of view or of objects seen from an unusual point of view. One sec after seeing a picture, a word will be presented, and the

subject will decide whether the word names the pictured object. Counterbalancing will ensure that the same objects and words appear equally often in the two conditions. GRA

**N92-11625#** Naval Submarine Medical Research Lab., Groton, CT.

**THE EFFECT OF BLINKING ON SUBSEQUENT DARK ADAPTATION Interim Report**

S. M. LURIA 14 May 1991 10 p

(AD-A240281; NSMRL-1170) Avail: NTIS HC/MF A02 CSCL 06/1

Night vision is extremely important for all operational forces, no less so for the submarine force. Periscope operators must be able to see at night, and great care is taken to ensure that they will be dark adapted when necessary. The crew in the control center routinely begins to dark adapt well in advance of nightfall. It is, thus, impossible to imagine that a submariner will not be dark adapted when necessary. Nevertheless, if the dark adaptation process could be speeded up, it would add to the efficiency of submarine operations. For this reason, a claim by Stryker (1990) that an individual will achieve dark adaptation very quickly if he blinks his eyes rapidly and forcefully for 15 to 30 seconds has aroused some interest. The claim was that this technique works for adults half of those individuals who have tried it. GRA

**N92-11626#** State Univ. of New York, Stony Brook.

**TRAINING, MUSCLE FATIGUE AND STRESS FRACTURES**

**Midterm Report, 28 Sep. 1990 - 15 May 1991**

CLINTON T. RUBIN 15 Jun. 1991 30 p

(Contract DAMD17-90-Z-0054; DA PROJ. 3M1-61102-BS-15)

(AD-A240386) Avail: NTIS HC/MF A03 CSCL 06/5

The objective of this three year program is to expand and intensify our research efforts on the pathogenesis of the stress fracture lesion, using an animal model to further identify those aspects of the physical regimen which exacerbate this debilitating condition. Thus far, the studies we have undertaken demonstrate that the origins of the lesion stem from tissue remodeling, not material microdamage. As importantly, the site of the lesion, when correlated to the mechanical environment to which the bone is subjected, emphasizes that the pathology predominates in areas of least strain, not those areas subject to greatest deformation. Finally, the pathology observed in the two animal models pursued in the first period of this contract is histologically identical to that which occurs in the human condition, demonstrating the applicability of these studies to the etiology of the human condition. GRA

**N92-11627\*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

**EXTRA-CORPOREAL BLOOD ACCESS, SENSING, AND**

**RADIATION METHODS AND APPARATUSES Patent**

**Application**

KENT D. CASTLE, inventor (to NASA) 16 Sep. 1991 24 p

(NASA-CASE-MSC-21775-1; NAS 1.71:MSC-21775-1;

US-PATENT-APPL-SN-760633) Avail: NTIS HC/MF A03 CSCL 06/2

The described invention is related to extra-corporeal blood access and radiation methods and apparatuses and, in particular, to subjecting flowing blood to energy in variety of forms, including radiation, electromagnetic force fields or atomic particles. It is directed to methods and apparatuses for accessing flowing blood and for subjecting the blood to electrical conductive, electrostatic or electromagnetic fields or for radiating the blood with some type of radiation, e.g., radio waves, ultrasonic or audio waves, microwaves, IR rays, visible light, UV radiation, x-rays, alpha, beta or gamma rays. An apparatus is employed which includes one or more access ports or windows for radiating blood and/or for sensing/analyzing blood. This invention is useful for killing viruses and bacteria in blood, monitoring blood for medical purposes, genetic modification of blood, and analyzing and/or treating blood components. NASA



**N92-11628\*** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

**INTRANASAL SCOPOLAMINE PREPARATION AND METHOD  
Patent Application**

LAKSHMI PUTCHA, inventor (to NASA) and NITZA M. CINTRON, inventor (to NASA) 25 Sep. 1991 11 p (NASA-CASE-MS-21858-1; NAS 1.71:MSC-21858-1; US-PATENT-APPL-SN-765615) Avail: NTIS HC/MF A03 CSCL 06/5

A new method and preparation for intranasal delivery of scopolamine provides a safe and effective treatment for motion sickness and other conditions requiring anticholinergic therapy. The preparation can be in the form of aqueous nasal drops, mist spray, gel or ointment. Intranasal delivery of scopolamine has similar bioavailability and effect of intravenous delivery and is far superior to oral dosage. Scopolamine is prepared in a buffered saline solution at the desired dosage rate for effective anticholinergic response. NASA

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## BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

**A92-11138\*** Illinois Univ., Savoy.

**TASKILLAN II - PILOT STRATEGIES FOR WORKLOAD  
MANAGEMENT**

LEON D. SEGAL and CHRISTOPHER D. WICKENS (Illinois, University, Savoy) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 1. Santa Monica, CA, Human Factors Society, 1990, p. 66-70. refs (Contract NAG2-38) Copyright

This study focused on the strategies used by pilots in managing their workload level, and their subsequent task performance. Sixteen licensed pilots flew 42 missions on a helicopter simulation, and were evaluated on their performance of the overall mission, as well as individual tasks. Pilots were divided in four groups, defined by the presence or absence of scheduling control over tasks and the availability of intelligence concerning the type and stage of difficulties imposed during the flight. Results suggest that intelligence supported strategies that yielded significant higher performance levels, while scheduling control seemed to have no impact on performance. Both difficulty type and the stage of difficulty impacted performance significantly, with strongest effects for time stress and difficulties imposed late in the flight. Author

**A92-11139**

**PLANNING AND SCHEDULING IN FLIGHT WORKLOAD  
MANAGEMENT**

MIREILLE RABY and CHRISTOPHER D. WICKENS (Illinois, University, Savoy) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 1. Santa Monica, CA, Human Factors Society, 1990, p. 71-75. Research supported by USAF. refs Copyright

A closed loop adaptive model for workload has been proposed by Hart and Wickens (1990) in which planning and scheduling activities contribute to the increase or diminution of workload the operator may experience. Of relevance to this model is people's ability to estimate how much time they need to complete a task, their ability to prioritize the tasks to be performed, and their ability to schedule those tasks on time. Thirty pilots flew three ILS approaches under different levels of workload. The data indicates that the increase in workload affected flight performance as well as the planning and scheduling of tasks with different levels of prioritization. This level of prioritization closely approximated the flight instructor's and the subjects' subjective, ratings of the degree

of importance of each task. It is also suggested that overconfidence in time estimation may depend on the task involved. Finally, the data is discussed in terms of its implication to a closed loop adaptive model of workload. Author

**A92-11140**

**MENTAL MODELS, MENTAL WORKLOAD, AND INSTRUMENT  
SCANNING IN FLIGHT**

DONALD E. HAMELUCK (York University, Toronto, Canada) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 1. Santa Monica, CA, Human Factors Society, 1990, p. 76-80. Sponsorship: Department of Supply and Services. refs (Contract DSS-W7711-7-7004/01-SE) Copyright

This paper examined the correspondence between pilots' instrument scanning behavior during instrument approaches and their general knowledge (or 'prototypical mental model') of their information requirements and subjective reactions associated with procedural phases of the approaches. Factor analysis was used to characterize each of these two domains in terms of a set of underlying factors. The relationships between the factors of the instrument scanning domain and those of the mental model domain appeared to be based on the procedural requirements of the approaches (e.g., reduce airspeed and altitude). Author

**A92-11141\*** Montclair State Coll., Upper Montclair, NJ.

**AN INITIAL TEST OF A NORMATIVE FIGURE OF MERIT FOR  
THE QUALITY OF OVERALL TASK PERFORMANCE**

MOIRA LEMAY (Montclair State College, Upper Montclair, NJ) and J. R. COMSTOCK, JR. (NASA, Langley Research Center, Hampton, VA) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 1. Santa Monica, CA, Human Factors Society, 1990, p. 81-85. refs Copyright

An overall indicator, or Figure Of Merit (FOM), of the quality of crew/vehicle system performance is needed to establish the effect of workload on efficiency and to identify overload conditions. A normative FOM is proposed in which performance is measured on a representative task and a normative data base obtained. FOMs for subsequent executions of the task are then reported in terms of weighted deviations from average task performance. Performance of discrete tasks is measured primarily in terms of subtask time and errors. Discrete task performance is then combined with a measure of continuous vehicle control. In order to test the normative FOM procedure, the technique was applied to an existing set of data from a simulated landing task in which standard communications with ATC was compared with a data link communications system. The results indicated that while mean task performance was not affected, task variability, as measured by the FOM, was significantly higher when data link communications were used. In order to establish the sensitivity of the normative FOM method, further testing of the measure is recommended. Author

**A92-11145**

**A SECONDARY ANALYSIS COMPARING SUBJECTIVE  
WORKLOAD ASSESSMENTS WITH U.S. ARMY AIRCREW  
TRAINING MANUAL RATINGS OF PILOT PERFORMANCE**

JOHN E. STEWART, II and RONALD J. LOFARO (U.S. Army, Research Institute for the Behavioral and Social Sciences, Alexandria, VA) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 1. Santa Monica, CA, Human Factors Society, 1990, p. 104-108. refs Copyright

The present research effort sought to determine the validity of subjective workload estimates for Aircrew Training Manual (ATM) tasks for the UH-60 helicopter generated via a modified Delphi technique. Delphi weights were found to predict performance ratings on the ATM tasks; ATM tasks associated with accidents also had higher Delphi weights than did those not so associated. Author

A92-11147

**A VALIDATION OF SWAT AS A MEASURE OF WORKLOAD INDUCED BY CHANGES IN OPERATOR CAPACITY**

JONATHAN M. HANKEY (Boeing Commercial Airplanes, Wichita, KS) and THOMAS A. DINGUS (Idaho, University, Moscow) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 1. Santa Monica, CA, Human Factors Society, 1990, p. 112-115. Research supported by Boeing Military Airplanes. refs

Copyright

Attention is given to the interactive effects of workload induced by changes in task difficulty, fatigue induced by time-on-task, and fatigue induced by sleep deprivation on pilot performance. It was found that the subjective workload assessment technique (SWAT) varied reliably for the main effects of time-on-task, sleep deprivation, and task difficulty. It is concluded that SWAT is sensitive to workload induced by changes in operator capacity O.G.

A92-11151\* University of Southern California, Los Angeles.

**AGE AND THE ELDERLY INTERNAL CLOCK - FURTHER EVIDENCE FOR A FUNDAMENTALLY SLOWED CNS**

MICHAEL T. CANN, MAX VERCRUYSEN (Southern California, University, Los Angeles, CA), and P. A. HANCOCK (Minnesota, University, Minneapolis) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 1. Santa Monica, CA, Human Factors Society, 1990, p. 158-162. Research supported by Parsons Foundation, University of Southern California, and NASA. refs

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Age-related differences in accuracy of time estimation have been studied. It is found that compared to the younger subjects (mean age 25 years), the older adults (mean age 70 years) consistently overestimated the target 10-sec interval when they had to simultaneously perform an interpolating task (i.e., count backwards by subtractions of three). O.G.

A92-11160

**COMPARISON OF THE EFFECTS OF TWO ANTIHISTAMINES ON COGNITIVE PERFORMANCE, MOOD, AND PERCEIVED PERFORMANCE**

VALERIE J. B. RICE (U.S. Army, Research Institute for Environmental Medicine, Natick, MA) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 1. Santa Monica, CA, Human Factors Society, 1990, p. 598-602. Research supported by U.S. Army. refs

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This study compared the effects of three treatments (two antihistamines and one placebo) on cognitive information processing, mood, subjective feelings of drowsiness, and subjective performance ratings in 28 healthy men. Evaluations were given at 1, 3, 5, 7, 9, 11, 13, and 15 hours post ingestion. Results revealed performance decrements post diphenhydramine (benadryl) ingestion on three tasks. No decrements in performance were found post ingestion of hismanal. Subjective effects of mood were noted for both antihistamines; however, these effects were greater post benadryl. Subjects were able to determine receipt of a placebo versus an antihistamine following ingestion of either a placebo or benadryl. Results suggest that hismanal is superior to benadryl for avoidance of subjective effects and performance of information processing tasks. Author

A92-11165

**INTERRUPTION OF A MONOTONOUS ACTIVITY WITH COMPLEX TASKS - EFFECTS OF INDIVIDUAL DIFFERENCES**

PHILIPPE CABON, ALEX M. COBLENTZ, and REGIS MOLLARD (Paris V, Universite, France) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 2. Santa Monica, CA, Human Factors Society, 1990, p. 912-916. Research supported by DRET. refs

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The present study investigates the fluctuations of vigilance and performance for operators working in monotonous conditions in

laboratory in order to analyze the effect of breakdown in monotony on arousal and human performance and to explore individual differences in human performance. Physiological data were collected to study the variation of arousal, and response times and omission were used as a performance index. Two kinds of behavior are defined: stable subjects and subjects characterized by fluctuations both for arousal and performance during the task. During the daytime period, breakdown of monotony was found to have a positive effect on performance especially for subjects with fluctuations of arousal. Nighttime condition creates sleep deprivation with the consequence that the efficiency of the reactivation due to breakdown by a sustained task is not demonstrated. Results are discussed with regard to the theory of Fisk and Schneider (1985) on automated and controlled mental processing during monotonous activities. C.A.B.

A92-11166

**MODELING INDIVIDUAL DIFFERENCES AT A PROCESS CONTROL TASK**

C. M. LEWIS (Pittsburgh, University, PA) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 2. Santa Monica, CA, Human Factors Society, 1990, p. 917-921. refs

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Individual differences at process control tasks are difficult to analyze because similar system performance may result from different control strategies. This paper introduces a methodology for describing rule and skill based components of performance directly, using machine learning techniques. Similarity among strategies is shown to have a greater effect on performance than training interventions. The behavior of two subjects who are nearly identical in performance but vary greatly in strategy is examined to illustrate the potential of this approach for assessing individual differences at process control tasks. Author

A92-11167

**FACTORS GOVERNING PERFORMANCE IN A VISUAL INTERCEPTION TASK**

SUSAN C. FISCHER (Anacapa Sciences, Inc., Santa Barbara, CA) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 2. Santa Monica, CA, Human Factors Society, 1990, p. 929-933. refs

(Contract N00014-86-C-0865)

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Two experiments examined factors governing performance in a dynamic spatial task requiring object interception. In the two experiments, several variables were systematically manipulated, including target trajectory, decision time, and interceptor to target speed ratio. In both experiments a systematic linear relationship between actual response time and decision time was observed. The slope of this function was less than 1, indicating that subjects were less sensitive to variation in actual decision time than an 'ideal' observer. Performance patterns further indicated that subjects utilized both speed and distance information to guide their judgments, but failed to adequately incorporate speed information. Author

A92-11168

**EVALUATION OF PERFORMANCE-BASED TESTS DESIGNED TO PREDICT SUCCESS IN PRIMARY FLIGHT TRAINING**

DAVID J. BLOWER and DAN L. DOLGIN (U.S. Navy, Naval Aerospace Medical Research Laboratory, Pensacola, FL) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 2. Santa Monica, CA, Human Factors Society, 1990, p. 949-953. Research sponsored by U.S. Navy. refs

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A statistical assessment is presented of all the tests in the Naval Aerospace Medical Research Laboratory performance test battery designed to assess cognitive abilities, psychomotor skills, higher-order processes, time-sharing ability, and personality traits, when they enter as variables in a regression equation to predict success in primary flight training. The interactions of college major

and accession source with derived scores of three significant test sets contributed significant amounts of variability when added to the model. Results seem to indicate differential validity of these selection tests. R.E.P.

A92-11169

**DIFFERENCES IN TIME-SHARING ABILITY BETWEEN SUCCESSFUL AND UNSUCCESSFUL TRAINEES IN THE LANDING CRAFT AIR CUSHION VEHICLE OPERATOR TRAINING PROGRAM**

TATREE NONTASAK and DAN L. DOLGIN (U.S. Navy, Naval Aerospace Medical Research Laboratory, Pensacola, FL) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 2. Santa Monica, CA, Human Factors Society, 1990, p. 959-961. Research supported by U.S. Navy. refs

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Improved entry requirements for selection to the U.S. Navy landing craft air cushion (LCAC) vehicle operator training program are needed. This study analyzed trainee performance involving a combination of compensatory tracking (CT) and digit cancellation (DC) tasks. Successful trainees performed significantly better than unsuccessful trainees in most of the task measures. Performance differences approached the 0.05 significance level in the single-task DC but not in the single-task CT. In dual performance, where CT and DC were performed simultaneously, successful trainees' time-sharing abilities were significantly better. Additionally, DC and CT/DC time-sharing measures correlated with training grade. These findings suggest that a test of time-sharing ability has the potential to predict LCAC training program outcome. Author

A92-11173

**VIGILANCE IN TRANSPORT OPERATIONS - FIELD STUDIES IN AIR TRANSPORT AND RAILWAYS**

REGIS MOLLARD, ALEX M. COBLENTZ, and PHILIPPE CABON (Paris V, Universite, France) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 2. Santa Monica, CA, Human Factors Society, 1990, p. 1062-1066. Research supported by Direction Generale de l'Aviation Civile and Societe Nationale des Chemins de Fer Francais. refs

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The vigilance and performance of operators of aircraft and trains are examined in two field studies dedicated to determining which factors can modify pilot performance. Physiological data such as EEGs and EOGs and data on task observation are collected to evaluate attentiveness and the parameters of rest-activity cycles. Specific attention is given to the effects of automation on human performance by considering the reduced work schedules and boredom associated with automation. Vigilance is found to vary directly with workload for pilots, and high occurrences of decreased vigilance are identified for pilots during the cruise mode. Decreased vigilance can occur simultaneously for two crewmembers, thereby affecting the alternation of tasks. The train operators are found to experience decreased vigilance even at times of high activity, and a direct relation between sleep duration and rest onset is described. C.C.S.

A92-11174

**PREDICTING THE EFFECTS OF STRESS ON PERFORMANCE**

PETER A. HANCOCK (Minnesota, University, Minneapolis), MARK H. CHIGNELL, and MAX VERCRUYSEN (Southern California, University, Los Angeles, CA) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 2. Santa Monica, CA, Human Factors Society, 1990, p. 1081-1085. refs

Copyright

This paper examines a number of ways in which a recent model of stress and human performance may be operationalized to allow experiments and practitioners to assess and predict operator capability in stressful conditions. Particular focus is given to the limits of task capability, as the model emphasizes the task itself as the primary source of stress on the performer. The importance

of a model with such predictive capability forms the premise of the work, while the assessment of the present status of this and other models of stress forms the summary. Author

A92-11177

**TASK ANALYSIS/WORKLOAD (TAWL) - A METHODOLOGY FOR PREDICTING OPERATOR WORKLOAD**

DAVID B. HAMILTON and CARL R. BIERBAUM (Anacapa Sciences, Inc., Fort Rucker, AL) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 2. Santa Monica, CA, Human Factors Society, 1990, p. 1117-1121. refs

(Contract MDA903-87-C-0523)

Copyright

The TAWL methodology, developed to predict operator workload utilizing the information from a task analysis of the system, is described. By employing this methodology an analyst can develop a model of a system and utilize the model's output to determine the half-second intervals in which crewmembers experience high workload, which crewmembers experience high workload, and the components in which crewmembers experience high workload. These data enable system designers to redistribute or reduce workload over time, components, or crewmembers, and to identify design alternatives that result in lower workload. R.E.P.

A92-11183

**DEVELOPMENT AND EVALUATION OF A DIGITAL CRITICAL TRACKING TASK**

JONATHAN F. ANTIN (North Carolina State University, Raleigh), W. PATRICK GATEWOOD, JR., and RICHARD S. DUNN (U.S. Navy, Naval Air Test Center, Patuxent River, MD) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 2. Santa Monica, CA, Human Factors Society, 1990, p. 1209-1213. refs

Copyright

A study was undertaken to validate a digital critical tracking task (CTT) that was developed against comparable analog versions that have previously been reported, to compare pilot to nonpilot performance on the CTT, and to correlate a priori and subjective measures of tracking difficulty to measures of tracking behavior and performance. Five pilots and five nonpilots were asymptotically trained on the CTT. The data session included 14 trials of subcritical tracking difficulty. Results showed that subject performance was comparable to what would be expected of an analog CTT with similar task parameters, and no significant differences were found between the pilot and nonpilot groups. High correlations were found between performance measures, subjective ratings, behavioral measures, and the a priori measures of difficulty which tends to validate the digital CTT that was developed for use in future studies. Author

A92-11185\* Minnesota Univ., Minneapolis.

**WORKLOAD AND STRATEGIC ADAPTATION UNDER TRANSFORMATIONS OF VISUAL-COORDINATE MAPPINGS**

J. K. CAIRD, P. A. HANCOCK, M. G. WADE (Minnesota, University, Minneapolis), and M. VERCRUYSEN (Southern California, University, Los Angeles, CA) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 2. Santa Monica, CA, Human Factors Society, 1990, p. 1290-1294. refs

(Contract NAG1-1118)

Copyright

A study involving a bimanual pursuit-tracking task is conducted to examine strategic exploration of differing visual and motor coordination patterns emphasizing workload as an indicator of strategic behavior. The mappings are conducted for 16 possible variations of order, speed, and combination. Performance is assessed by means of the rms and percent time-on-target, and the NASA task-load index is used to classify subjective reports on workload. The results are broken down into four primary performance mappings and four hybrid mappings called contradictory conditions. The order of difficulty of the conditions

is apparently determined by the workload, except that in the case of the three most difficult decoupled conditions some dissociation is reported. C.C.S.

**A92-11187**

**ATTENTION THEORY AS A GUIDE TO PART-TRAINING FOR INSTRUCTION OF NAVAL AIR-INTERCEPT CONTROL**

ANTHONY D. ANDRE and GAVAN LINTERN (Illinois, University, Savoy) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 2. Santa Monica, CA, Human Factors Society, 1990, p. 1347-1351. Research supported by U.S. Army. refs  
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Air-intercept control is a complex Navy combat task which requires a radar operator to advise a pilot of optimum headings for avoiding, meeting, or intercepting other aircraft. The goal of the research reported here was to explore procedures for teaching some critical elements of air-intercept control with a pc-based version of the training simulation that is normally used for instruction. In one strategy, specific skill-based elements of the task were taught in isolation and were then recombined into the whole task. In another strategy, an abstract procedural task was added by isolating those features that contributed to the spatial and temporal coherence of the whole task. The procedure-based version of the task emerged as a training strategy that could help students develop resistance to potentially disruptive effects of making the task more difficult. The results are viewed as supporting an approach to training that attempts to alleviate resource overload so that learning may proceed with maximum efficiency while, at the same time, allowing critical task elements related to time-sharing skills to be practiced. Author

**A92-11189**

**THE EFFECTIVENESS OF AERONAUTICAL DECISIONMAKING TRAINING**

ALAN DIEHL (USAF, Inspection and Safety Center, Norton AFB, CA) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 2. Santa Monica, CA, Human Factors Society, 1990, p. 1367-1371. Research supported by Aircraft Owners and Pilots Association and General Aviation Manufacturers Association. refs  
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Several programs have been developed and tested to reduce the frequency of aircrew decisional errors. 'Aeronautical decisionmaking' (ADM) materials are intended to enhance the judgment abilities of the individual aviators. A review of six empirical ADM studies reveals that such programs reduced the frequency of pilot errors from 8 to 46 percent. The use of such materials by a large commercial operator resulted in 54 percent decrease in their accident rate. Author

**A92-11190**

**A COMPARISON OF TWO TYPES OF TRAINING INTERVENTIONS OF TEAM COMMUNICATION PERFORMANCE**

DONALD L. LASSITER, JEREMY S. VAUGHN, VIRGINIA E. SMALTZ, BEN B. MORGAN, JR. (Central Florida, University, Orlando, FL), and EDUARDO SALAS (U.S. Navy, Naval Training Systems Center, Orlando, FL) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 2. Santa Monica, CA, Human Factors Society, 1990, p. 1372-1376. refs  
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The purpose of this research was to examine the effects of different types of training interventions on team communication. Forty-five teams of two persons each viewed one of three training videotapes and then performed a low-fidelity helicopter simulation exercise. Trained raters were used to rate teams in terms of levels of their communications and mission performances. Finally, attitudes concerning aircrew coordination were measured before and after training. Results indicated that team communication skills were affected by the type of training intervention the team received. Specifically, the communication of teams in the skills group was

significantly better than that of the other two groups. No significant effect of training intervention was found for the mission performance or the attitude data, although a significant correlation was found between team communication performance and team mission performance. Author

**A92-11191**

**A MODEL FOR EVALUATION AND TRAINING IN AIRCREW COORDINATION AND COCKPIT RESOURCE MANAGEMENT**

ROBERT SIMON, DANIEL T. RISSER, EUGENE A. PAWLICK, SR. (Dynamics Research Corp., Wilmington, MA), and DENNIS K. LEEDOM (U.S. Army, Research Institute, Fort Rucker, AL) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 2. Santa Monica, CA, Human Factors Society, 1990, p. 1377-1381. refs  
(Contract DAHC35-89-D-0030)  
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Measures of aircrew coordination for analytical use are proposed to address the need for an aircrew-coordination framework based on attitudes and behavior. The conceptual framework for operator behaviors is presented in which consideration is given to both alternative decision-making models and task 'coupling'. The evaluation of the framework is conducted by means of a questionnaire, an aircrew-coordination evaluation checklist, and revised aircrew training manual tasks. The model is reported to be in use in aircrew coordination evaluations of 20 Black Hawk helicopter crews, and the methods are being applied to the investigation of accidents. The methods presented are concluded to be more coherent and rigorous measures of cockpit resource management and aircrew coordination than previously employed methods. C.C.S.

**A92-11192**

**DOES CREW COORDINATION BEHAVIOR IMPACT PERFORMANCE?**

RENEE J. STOUT, BEN B. MORGAN, JR. (Central Florida, University, Orlando, FL), JANIS A. CANNON-BOWERS, and EDUARDO SALAS (U.S. Navy, Naval Training Systems Center, Orlando, FL) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 2. Santa Monica, CA, Human Factors Society, 1990, p. 1382-1386. refs  
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It has been well established that human error and poor management of cockpit resources contribute to aircraft accidents. For this reason, there has been a recent proliferation of aircrew coordination training programs, yet the effectiveness of these programs has not been shown definitively. The present investigation demonstrated that link between crew coordination behavior and mission effectiveness, thus supporting the continued development of programs aimed at training aircrew coordination skills. The results further suggest that interventions concentrate on pilot coordination skills, since these skills appear to be most important to mission performance. Author

**A92-11199**

**EFFECTS OF NOISE AND WORKLOAD ON PERFORMANCE WITH TWO OBJECT DISPLAYS VS. A SEPARATED DISPLAY**

KAN ZHANG and CHRISTOPHER D. WICKENS (Illinois, University, Savoy) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 2. Santa Monica, CA, Human Factors Society, 1990, p. 1499-1503. refs  
(Contract DAAA15-86-K-0013)  
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The effects are examined of stress on the processing of displayed information from two types of object displays, when dimensions are formed by the color and size of a bar, by the height and width of a rectangle, and from a separated two-bargraph display. Subjects either integrated information across the two dimensions of each display or focused attention on each dimension in a simulated airborne decision task. Results indicated that information integration was best supported by the rectangle display at higher levels of workload. Both the color bar and the bargraph display were associated with poor performance in the integration

task, but were superior in the focused attention task. An emergent feature of the rectangle (its area) was found to be the critical element supporting information integration and disrupting focused attention. The imposition of noise enhanced the subjective feeling of stress. Noise reduced the resource demands of both object displays and increased the resource demands of the separate bargraph display.

C.A.B.

**A92-11200****CENTRAL PROCESSING LOAD, RESPONSE DEMANDS AND TRACKING STRATEGIES**

BARRY P. GOETTL and JANE JOSEPH (Clemson University, SC) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 2. Santa Monica, CA, Human Factors Society, 1990, p. 1504-1508. refs  
(Contract F49620-88-C-0053)

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The present experiment investigates the processing demands associated with two tracking strategies: double-impulse and continuous. Twelve subjects performed a Sternberg memory search task concurrently with a compensatory tracking task using either strategy. Central processing demands of both tasks were manipulated as well as the response demands of the Sternberg task. The two tasks showed little resource competition for central processing resources. Response load resulted in resource competition, but did not show any strategy differences. Results are discussed with regard to the importance of understanding strategy differences for workload analysis.

Author

**A92-11201****REDUCTION OF COGNITIVE WORKLOAD THROUGH INFORMATION CHUNKING**

MICHAEL J. KAHN, KAY C. TAN, and ROBERT J. BEATON (Virginia Polytechnic Institute and State University, Blacksburg) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 2. Santa Monica, CA, Human Factors Society, 1990, p. 1509-1513. refs  
(Contract F33615-88-D-0532)

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Two experiments were conducted to determine whether grouping of icons on complex graphic displays reduces information processing loads, as measured by the Subjective Workload Assessment Technique and error rates. In Experiment 1, between 2 and 25 symbols were presented on a computer display. Participants were asked to chunk symbols under class labels and store these labels in short-term memory. Two different display forming variables were tested: spatial proximity grouping of icons was manipulated across three levels, while temporal grouping was manipulated across two levels. Results suggest that display grouping helps operators organize, encode, and store information into task relevant chunks and, in turn, reduces subjective workload and error rates. Experiment 2 was similar to Experiment 1, except that participants were required to remember individual icon names. Results suggest that for chunk formation, storage, and parsing tasks, display grouping may reduce subjective workload, but not error rates.

Author

**A92-11202****THE EFFECTS OF SIMULATOR TIME DELAYS ON A SIDESTEP LANDING MANEUVER - A PRELIMINARY INVESTIGATION**

JAMES D. WHITELEY (USAF, Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH), STEVEN L. LUSK, and MATTHEW S. MIDDENDORF (Logicon Technical Services, Inc., Dayton, OH) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 2. Santa Monica, CA, Human Factors Society, 1990, p. 1538-1541. refs

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The use of a variety of idealized tracking tasks as a means of studying the effects of simulator time delay has been ongoing for five years at the Armstrong Aerospace Medical Research Laboratory (AAMRL). Results from these studies generated some

interest in evaluating more complex tasks. Based on related inflight research, a sidestep landing task scenario was selected as a means of making the simulator task more realistic and also sensitive to the effects of time delay. In this experiment, twelve subjects were placed in a final-approach landing configuration and later cued to sidestep to an adjacent, parallel runway. Subjects completed 40 trials in each of three time delay conditions (90, 200, and 300 ms) in a latin square design. Significant differences were discovered among the delay conditions in the approach and landing performance data.

Author

**A92-11205\*** Technion - Israel Inst. of Tech., Haifa.**TRACKING AND LETTER CLASSIFICATION UNDER DICHOTIC AND BINOCULAR VIEWING CONDITIONS**

DANIEL GOPHER, ARTHUR GRUNWALD, ZVI STRAUCHER (Technion - Israel Institute of Technology, Haifa), and RUTH KIMCHI (Haifa University, Israel) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 2. Santa Monica, CA, Human Factors Society, 1990, p. 1557-1561. Research supported by NASA. refs

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Subjects were required to fly a simulated helicopter path, while also classifying letter pairs presented intermittently at 5 retinal locations. Binocular and Dichoptic conditions were compared by employing color filters. Tracking under dichoptic conditions was strongly influenced by the absence of a common optical axis. Classification performance also deteriorated and was influenced by the conditions of tracking.

Author

**A92-13015****STRESS AND ERROR IN AVIATION**

ERIC FARMER, ED. (RAF, Institute of Aviation Medicine, Farnborough, England) Aldershot, England and Brookfield, VT, Avebury Technical, 1991, 170 p. For individual items see A92-13016 to A92-13027.

Copyright

The present conference on stress and error in aviation encompasses issues relating stress with workload, sleep management, aviation safety, testing systems, the effects of trauma, transmeridian travel, and human factors. Specific issues addressed include personality and task characteristics in helicopter pilot stress, a psychophysiological assessment test system, the assessment of pilot and weapon-system operator workloads, the development of a working model of flight-crew underload, the long-term psychological consequences of a major aircraft accident, and trauma-induced cyclothymia. Also addressed are the implications of irregular work and rest in civil air operations, a comparison of fatigue-related accidents across modes of transport, human factors in cabin safety, and the importance of type-II error in aviation safety research.

C.C.S.

**A92-13016****PERSONALITY, TASK CHARACTERISTICS AND HELICOPTER PILOT STRESS**

CLAUDIA HARSS, MICHAEL KASTNER, and LILLY BEERMAN (Universitaet der Bundeswehr, Munich, Federal Republic of Germany) IN: Stress and error in aviation. Aldershot, England and Brookfield, VT, Avebury Technical, 1991, p. 3-14. refs

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The transactional view of stress is examined in helicopter pilots flying at low-altitude with night-vision goggles (NVGs). The sample of 50 pilots includes 27 NVG pilots, 12 daytime pilots as a control group, and 11 NVG technicians, and data from a total of 119 flights and 290 flight situations. Objective and subjective characteristics are assessed for personal, situational, and transactional variables by collecting psychological, physiological, and observational data before, during, and after the tests. Recommendations regarding flight safety are developed based on the identification of situations that lead to critical flight situations and stress. The situation-person interactions that lead to stress most regularly are the risk-taking and anxiety situations, in which the pilots' perceptions of the situations and themselves are the

least accurate. The more 'daring' pilots also tended to influence the occurrence of difficult situations. C.C.S.

#### A92-13017

##### **PATS - PSYCHOPHYSIOLOGICAL ASSESSMENT TEST SYSTEM**

GLENN F. WILSON (USAF, Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) and CELIA G. OLIVER (Systems Research Laboratories, Inc., Dayton, OH) IN: Stress and error in aviation. Aldershot, England and Brookfield, VT, Avebury Technical, 1991, p. 15-25. refs

Copyright

This paper describes the development of a new generation of psychophysiological test battery to replace the first battery, the Neuropsychological Workload Test Battery (NWTB). The new battery, the Psychophysiological Assessment Test System (PATS), has a much improved user interface, expanded capabilities for use in simulator facilities, and enhanced data reduction and management capabilities, and includes the ability to conduct statistical analysis. Author

#### A92-13018

##### **PSYCHOPHYSIOLOGICAL ASSESSMENT OF PILOT AND WEAPON SYSTEM OPERATOR WORKLOAD**

GLENN F. WILSON (USAF, Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) and PENNY FULLENKAMP (Systems Research Laboratories, Inc., Dayton, OH) IN: Stress and error in aviation. Aldershot, England and Brookfield, VT, Avebury Technical, 1991, p. 27-34. refs

Copyright

Physiological data are measured for 10 F4 crews to study the effects of differential workloads on the pilot and the weapons-system operator (WSO) and examine corresponding levels of stress. The data are derived from both air-to-ground training missions and two tracking tasks in the laboratory so that actual performance data can be compared to previous laboratory studies. Physiological responses are examined in terms of 23 different premission and mission segments and include heart rate, eye blink, brain evoked potentials (EPs), and subjective ratings. Higher heart rates are reported for the pilots during airborne segments, and the number of eye blinks is higher overall during flight segments. WSO heart-rate and EP ratings are significantly higher for the segments when the WSOs actually fly the aircraft. The workload related to F4 missions is concluded to be the primary factor that affects psychophysiological sensitivity, and the measures presented are good indicators for monitoring workload. C.C.S.

#### A92-13019

##### **THE DEVELOPMENT OF A WORKING MODEL OF FLIGHT CREW UNDERLOAD**

CAROLE D. BRABY, HELEN C. MUIR, and DON HARRIS (Cranfield Institute of Technology, England) IN: Stress and error in aviation. Aldershot, England and Brookfield, VT, Avebury Technical, 1991, p. 35-52. Research supported by British Airways, PLC. refs

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The concept of underload and the factors that affect this type of workload are set forth, and a subjective evaluation of flight crews is undertaken to study underload with respect to automation. Operator states/conditions associated with task performance are used to define underload, and the subjective component (such as boredom) is found to be significant. After examining models of underload based on workload and boredom, a study of 250 commercial flight-crew members is described. Although the need to examine the physiological and behavioral components of underload states is apparent, the subjective study indicates that fatigue, boredom, frustration, and distraction dictate the extent of the underload state. The factors increase with sector length and flight-deck automation, and it is concluded that underload and overload should be integrated into a workload model for aircraft crews. C.C.S.

#### A92-13020

##### **THE LONG-TERM PSYCHOLOGICAL CONSEQUENCES OF A MAJOR AIRCRAFT ACCIDENT**

CLAIRE MARRISON and TRACY HARRIS (Cranfield Institute of Technology, England) IN: Stress and error in aviation. Aldershot, England and Brookfield, VT, Avebury Technical, 1991, p. 53-63. refs

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A study is reported in which the psychological distress of the survivors and bereaved was measured five years after a major aircraft accident. The psychological first aid, counseling, and social support received by the victims are related to psychological health. Implications for the management and counseling of disaster victims are discussed. Author

#### A92-13021

##### **A CASE OF TRAUMA-INDUCED CYCLOTHYMIA IN A PILOT**

HANS-PETER GOERRES (German Air Force, Institute of Aerospace Medicine, Fuerstenfeldbruck, Federal Republic of Germany) IN: Stress and error in aviation. Aldershot, England and Brookfield, VT, Avebury Technical, 1991, p. 65-70.

Copyright

The history of cyclothymic episode is described to present evidence for the efficacy of client-centered therapy over typical rehabilitation programs. The trauma-induced psychological condition is described from its inception through the present status of the subject. Specific attention is given to the changes in the subject's perception and abilities throughout the period, and the internal relationships and treatment program are described in detail in terms of effectiveness. The subject was given a contact person throughout the period of rehabilitation, and the treatment program was based on a well-defined and busy working day. It is shown that the client-centered therapy is expensive and work-intensive yet significantly more effective for developing a productive cyclothymic subject. C.C.S.

#### A92-13022

##### **STRESS AND WORKLOAD - MODELS, METHODOLOGIES AND REMEDIES**

DYLAN M. JONES (University College, Cardiff, Wales) IN: Stress and error in aviation. Aldershot, England and Brookfield, VT, Avebury Technical, 1991, p. 71-77.

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Conceptual and methodological advances regarding the relationship between stress and workload are reviewed and analyzed in terms of lacunas in research. Models of stress include predictive and descriptive techniques, and key features are mentioned including the optimum, crew interaction, multiple causation, and perceptual and evaluative processes. The methodological approaches described address issues such as the effectiveness of subjective evaluation versus physiological data, the ideographic approach, and the virtue of simulation. The usefulness of the perceptual approach to stress evaluation is emphasized, and training for self-awareness is proposed as a remedy for fatigue, boredom, and underload. C.C.S.

#### A92-13023

##### **IRREGULARITY OF WORK AND REST AND ITS IMPLICATIONS FOR CIVIL AIR OPERATIONS**

MICHAEL B. SPENCER and ANTHONY N. NICHOLSON (RAF, Institute of Aviation Medicine, Farnborough, England) IN: Stress and error in aviation. Aldershot, England and Brookfield, VT, Avebury Technical, 1991, p. 81-97. refs

Copyright

An experiment is described in which the impact of irregular rest-activity patterns on levels of alertness is studied. Both physiological parameters and subjective considerations are evaluated while the performance of the subjects is monitored in an isolated setting. The variation in performance approximates the sinusoidal pattern related to temperature fluctuations, and a cubic trend is identified in the time-on-task effect. The level of performance corresponding to 12 hours of task time beginning in the early morning can only be maintained for 6 hours when the

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task time is nocturnal. The most severe problems with respect to performance tend to occur during long periods that begin in the late afternoon and early evening. It is concluded that the interaction of the time-on-task effect and circadian rhythm are responsible for the reduced performance level. C.C.S.

**A92-13024**

### **SLEEP AFTER TRANSMERIDIAN FLIGHTS - IMPLICATIONS FOR AIR OPERATIONS**

BARBARA M. STONE (RAF, Institute of Aviation Medicine, Farnborough, England) IN: Stress and error in aviation. Aldershot, England and Brookfield, VT, Avebury Technical, 1991, p. 107-122. refs

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The sleep patterns of aircrew after transmeridian and polar flights are examined and compared to determine how such flights can directly influence subsequent performance. Sleep patterns are presented for an aircrew following an 8-hr westward time-zone change, and the sleep patterns and circadian rhythms are given for an aircrew operating a 7-day polar schedule. Sleep onset in the time-zone case is fast on the first day, although wakefulness is a problem in the second half of the sleep period. After initial sleep-pattern changes, the polar-flight crew experienced sleep loss due to the displaced circadian rhythm. Resynchronizing to the circadian rhythms can require up to 6 days although the rhythms often realign in advance of the circadian phase. The paper concludes that recovery time is crucial in optimizing the performance of air operations after long-duration transmeridian flight and particularly after flying polar routes. C.C.S.

**A92-13026**

### **THE RIGHT STUFF IN THE WRONG SYSTEM?**

ALISE WEIBULL (National Defence Research Establishment, Karlstad, Sweden) and INGER MARTENSSON (Swedish Air Force, Stockholm, Sweden) IN: Stress and error in aviation. Aldershot, England and Brookfield, VT, Avebury Technical, 1991, p. 143-149. refs

Copyright

The perception and behavior of Swedish Air Force squadrons are examined with respect to daily work content and other factors that contribute to dissatisfaction. Subjective and other data from 200 interviews with the squadrons are analyzed for a psychological evaluation of what constitutes a 'good' job. Questionnaires, interviews, written records of statistics, and official Air Force documents are used to compile relevant information. The concepts of qualification, cooperation, and security are defined and applied to different aspects of squadron life including organizational, group, and individual areas. The results show that the organization needs to adjust to changing conditions, and 5 themes are proposed that describe major findings from the study and appropriate courses of action. C.C.S.

**A92-13027**

### **THE IMPORTANCE OF THE TYPE II ERROR IN AVIATION SAFETY RESEARCH**

DON HARRIS (Cranfield Institute of Technology, England) IN: Stress and error in aviation. Aldershot, England and Brookfield, VT, Avebury Technical, 1991, p. 151-157. refs

Copyright

It is argued that in certain cases the Type II decision error is the error to avoid in research related to aviation safety. This is illustrated with reference to the relative accident rates of two-crew versus three-crew commercial jet aircraft. Further examples in which the Type II error may be of importance are briefly outlined, as are some of the drawbacks associated with the use of the Type II error. Author

**N92-10282\*#** Research Inst. for Advanced Computer Science, Moffett Field, CA.

### **HUMAN PERFORMANCE MEASUREMENT: VALIDATION PROCEDURES APPLICABLE TO ADVANCED MANNED TELESCIENCE SYSTEMS**

RICHARD F. HAINES 12 Feb. 1990 35 p Sponsored in part

by USRA

(Contract NCC2-387)

(NASA-CR-185447; NAS 1.26:185447; RIACS-TR-90-10) Avail: NTIS HC/MF A03 CSCL 05/9

As telescience systems become more and more complex, autonomous, and opaque to their operators it becomes increasingly difficult to determine whether the total system is performing as it should. Some of the complex and interrelated human performance measurement issues are addressed as they relate to total system validation. The assumption is made that human interaction with the automated system will be required well into the Space Station Freedom era. Candidate human performance measurement-validation techniques are discussed for selected ground-to-space-to-ground and space-to-space situations. Most of these measures may be used in conjunction with an information throughput model presented elsewhere (Haines, 1990). Teleoperations, teleanalysis, teleplanning, teledesign, and teledocumentation are considered, as are selected illustrative examples of space related telescience activities. Author

**N92-10283#** City Univ. of New York, NY.

### **TEST ANXIETY AND POST PROCESSING INTERFERENCE, 2 Interim Report, Sep. 1982 - Sep. 1986**

SIGMUND TOBIAS and JOANNE SACKS Jul. 1991 18 p

(Contract MDA903-82-0353)

(AD-A239819; ARI-RN-91-88) Avail: NTIS HC/MF A03 CSCL 05/8

This experiment was performed to determine whether test anxiety interferes in the retrieval of prior learnings from long-term memory and to investigate the degree to which anxiety affected post processing interference. Thirty students were administered Sarason's Text Anxiety Scale and four subtests of Weinstein's Learning and Study Skills Inventory (LASSI). Students were asked to memorize two 18-word lists, each consisting of three different categories, to a criterion of one perfect recall. Students were randomly assigned to one of three conditions: (1) acquisition stress ego involving instruction administered prior to the beginning of the task, (2) ego involving instructions after acquisition, or (3) no ego involving instruction of any kind. It is conceivable that study skills, like test anxiety, affect performance mainly in the presence of effective stress. GRA

**N92-10284#** Yale Univ., New Haven, CT. Dept. of Psychiatry. **FEAR-POTENTIATED STARTLE AS A MODEL SYSTEM FOR ANALYZING LEARNING AND MEMORY** Final Report, 1 Jul. 1987 - 31 Jan. 1991

MICHAEL DAVIS 31 Jan. 1991 4 p

(Contract AF-AFOSR-0336-87; AF PROJ. 2312)

(AD-A239994; AFOSR-91-0749TR) Avail: NTIS HC/MF A01 CSCL 05/8

Research during this funding period has focussed on the role of a particular brain area, the amygdala, in fear conditioning, using increased acoustic startle amplitude in the presence of a stimulus previously paired with shock as a measure of fear in rats. We have found that: (1) electrical stimulation of the amygdala increases startle; (2) mechanical or chemical lesions of the amygdala prevent either footshock or stimuli paired with footshock from elevating startle; (3) there is a direct anatomical connection between the central nucleus of the amygdala and a specific point along the acoustic startle pathway; (4) lesions at several levels of this connection between the amygdala and the startle circuit block conditioned and unconditioned fear; (5) local infusion of specific receptor antagonists into the amygdala prevent the development of fear conditioning; and (6) presentation of a conditioned fear stimulus activates early expression genes (c-fos) in the amygdala. The data strongly implicate the amygdala as a critical brain structure for both the acquisition and expression of conditioned and unconditioned fear. Drugs that reduce anxiety in humans may act by interacting with specific receptors in the amygdala. GRA



**N92-10285#** California Univ., Irvine. Center for the Neurobiology of Learning and Memory.

**SYNAPTIC PLASTICITY AND MEMORY FORMATION Annual Technical Report, 15 May 1990 - 14 May 1991**

GARY LYNCH 14 Jun. 1991 6 p

(Contract AF-AFOSR-0383-89; AF PROJ. 2312)

(AD-A240121; AFOSR-91-0708TR) Avail: NTIS HC/MF A02

CSCL 05/8

The goal of the project is to define the mechanisms responsible for inducing, expressing, and stabilizing long-term synaptic potentiation (LTP), a form of physiological plasticity that is likely to be responsible for the encoding of memory in telencephalic networks. Studies in the past year defined the cellular changes likely to be responsible for expressions. The nootropic (cognitive enhancing) drug aniracetam prolongs the open time of post-synaptic receptors mediating fast synaptic transmission. The LTP changes the effect of the drug on synaptic responses in hippocampus; manipulations that enhance responses by increasing release do not interact with the drug. By far the most plausible explanation of this result is that LTP modifies receptors. This conclusion is supported by negative results from experiments testing the hypotheses that LTP is due to changes in release, receptor number, or spine resistance. GRA

**N92-10286#** New York Univ., New York. Dept. of Psychology. **VISUAL MOTION PERCEPTION Final Report, 1 Feb. 1988 - 31 Jan. 1991**

GEORGE SPERLING 15 Aug. 1991 279 p

(Contract AF-AFOSR-0140-88; AF PROJ. 2313)

(AD-A240133; AFOSR-91-0757TR) Avail: NTIS HC/MF A13

CSCL 06/4

The articles enclosed with this report describe work related to five aspects of visual information processing: (1) Continuing studies of two separate motion-computation systems in human vision and the derivation of the functional properties of each. (2) The investigation of three dimensional structure derived from two dimensional visual inputs. (3) A potent form of spatial contrast-gain-control was discovered and found to be not only frequency selective but also orientation specific. This form of local gain control may exemplify a universal form of neural normalization. (4) Studies of human pattern recognition of familiar shapes (such as letters) show that its statistical efficiency approaches an incredible 50 percent of the ideal detector's efficiency when the pattern is spatially bandpass filtered in a band whose wavelength is of the same order as the pattern itself. (5) Studies of real and simulated saccadic eye movements in which the same sequence of images that is produced on the retina during saccadic eye movements is artificially produced on a stationary retina. GRA

**N92-11629#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

**PERCEPTUAL STYLE AND AIR-TO-AIR TRACKING PERFORMANCE**

PAUL ATCHLEY Jul. 1991 8 p

(NASA-TM-102868; A-91032; NAS 1.15:102868;

USAAVSCOM-TR-90-A-004) Avail: NTIS HC/MF A02 CSCL 05/9

The relationship between perceptual style and tracking of a target was examined. Four pilots were given the Embedded Figures Test to assess their degree of field dependence or independence. They then flew a helicopter simulator and attempted to track an airborne target. A significant correlation was found between perceptual style and tracking performance. Field independent subjects were able to track the target for longer periods than field dependent subjects. Author

**N92-11630#** Air Force Human Resources Lab., Brooks AFB, TX. Manpower and Personnel Research Div.

**THE DEVELOPMENT OF BEHAVIORALLY ANCHORED RATING SCALES (BARS) FOR EVALUATING USAF PILOT TRAINING PERFORMANCE Interim Technical Paper, Oct. 1989**

- Mar. 1991

THOMAS R. CARRETTA and LAURIE C. WALTERS Jul. 1991

32 p

(AD-A239969; AL-TP-1991-0022) Avail: NTIS HC/MF A03

CSCL 05/6

The purpose of this study was to develop Behaviorally Anchored Rating Scales (BARS) which could be used by instructor pilots (IP's) to evaluate their students on eight personality characteristics considered important to flying fighter-type aircraft. IP's generated behavioral examples which reflected good, average, and poor job behaviors for each personality dimension. These job behaviors were randomized and presented to another group of IP's who tried to match each behavior with the personality characteristic it best represented. The IP's demonstrated sufficient agreement to develop BARS for four of the eight personality characteristics (achievement motivation, assertiveness, cooperativeness, and stress tolerance). The behavioral examples generated for the retained personality characteristics were evaluated for their use as scale anchor points. Several uses of BARS in the flying training environment were discussed. GRA

**N92-11631#** Wisconsin Univ., Madison.

**PICTURES AND ANAPHORA Annual Technical Report, 1 Jul. 1990 - 30 Jun. 1991**

ARTHUR M. GLENBERG and PETER KRULEY 29 Jul. 1991 26 p

(Contract AF-AFOSR-0367-89; AF PROJ. 2313)

(AD-A240153; AFOSR-91-0707TR) Avail: NTIS HC/MF A03

CSCL 05/8

Pictures help people to comprehend and remember texts. The goal of this project is to begin to understand how this occurs. Section 1 of this report contains a summary of work on several subgoals. Section 2 contains the report of two experiments testing the assumption that pictures provide an external memory which can assist working memory and thereby facilitate comprehension. We predicted that the availability of a diagram would interact with the difficulty of resolving anaphor references in texts. Resolution of an anaphor distance from its antecedent (which should stress working memory) should benefit greatly from a picture, whereas resolution of an anaphor near to its antecedent should benefit less from a picture. In experiments involving both cumulative and moving window presentations of texts, picture availability and distance separating antecedent from anaphor were manipulated. Although both picture presence and ease of anaphor resolution significantly improved subjects comprehension of the material, no evidence was found for an interaction of these factors. The results are interpreted as consistent with either dual code theory or aspects of working memory management that do not involve anaphor resolution. GRA

**N92-11632#** Pennsylvania State Univ., Hershey. Dept. of Behavioral Science.

**SERIAL AVERAGING IN THE CONSTRUCTION AND**

**VALIDATION OF PERFORMANCE TESTS Final Report, 1 Jun. 1990 - 31 May 1991**

MARSHALL B. JONES 9 Jul. 1991 70 p

(Contract N00014-90-J-1994)

(AD-A240313; TR-90-01) Avail: NTIS HC/MF A04 CSCL 05/8

The advent of the microcomputer has led to a renaissance in performance testing, that is, tests which sample what a person can do (remember, track, aim, detect, recognize, etc.) rather than what he or she knows. Psychometric theory, however, is based on knowledge tests. The unit of analysis is an item and the order of administering the items is arbitrary. In performance testing the unit of analysis is a trial and order of administration is not only nonarbitrary but often the only thing that distinguishes one trial from another. In a knowledge test it is not unreasonable to suppose that mean performance and interitem correlations are independent of order of administration. In a performance test it is. Typically, performance improves with practice and intertrial correlations tend toward a definite pattern as a function of order. The consequences of these differences for theory are drastic. In performance testing, both reliability and temporal stability frequently encounter optima as a test is lengthened. Hence, low reliability or stability may not be corrigible by increasing test length. Further, scoring all trials



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administered (the usual practice) may not yield the best obtainable predictive validity. Scoring only a subset of consecutive trials (early, middle, or late) frequently yields appreciably higher predictive validities than the conventional practice. GRA

**N92-11633#** New York Univ., New York. Dept. of Psychology.  
**PERCEPTION AND MEMORY OF PICTURES Annual Report, 1 Jul. 1989 - 30 Jun. 1990**

JOAN G. SNODGRASS 13 Aug. 1991 15 p  
(Contract AF-AFOSR-0442-89; AF PROJ. 2313)  
(AD-A240364; AFOSR-91-0739TR) Avail: NTIS HC/MF A03  
CSCL 12/9

This research is concerned with perception and memory of pictures. The theoretical motivation behind the experiments vary from area to area: in some cases, we want to test predictions of a connectionist model for picture recognition; in others we want to compare pictures with words to determine whether the two surface forms are understood at the same rate; in still others, the pictures are used as a vehicle to study questions about implicit memory. Although there are five areas of research, here I will mention highlights from only two. In the area of perception, interference in identification of a degraded image occurs when even more degraded images of the same object precede it. We tested and rejected an erroneous hypotheses about the object's identity interfering with subsequent recognition in favor of the explanation generated by our connectionist model. This explanation holds that transient activation of perceptual features common to the target and its distractors reduces the signal-to-noise ratio and causes interference. We were able to eliminate interference by having subjects solve math problems between presentations of the more degraded images. In the area of implicit memory, we found that the best priming stimulus for subsequent identification was a moderately fragmented one, as compared to a very fragmented or almost complete stimulus. We developed the perceptual closure hypothesis to account for this effect -- it says that the more difficult perceptual closure or completion of the fragmented figure is to be achieved, the more priming occurs, as long as closure is finally achieved. GRA

**N92-11634#** Illinois Univ., Urbana. Dept. of Psychology.  
**REMINDING-BASED LEARNING Annual Report, 21 Jun. 1990 - 20 Jun. 1991**

BRIAN H. ROSS 21 Aug. 1991 16 p  
(Contract AF-AFOSR-0447-89; AF PROJ. 2313)  
(AD-A240370; AFOSR-91-0758TR) Avail: NTIS HC/MF A03  
CSCL 05/8

When learning new cognitive skills involving problem solving, novices are often reminded of earlier problems. The use of earlier problems is a common means of problem solving and affects the learning of the skill. This project has three aims in understanding this learning. First, the representation of the resulting generalizations is being examined. Generalizations formed from reminders are likely to be conservative, in that they may be more tied to the examples than many current theories allow. A main aim of the project is to distinguish and test different forms of this conservatism. Second, the development of problem solving expertise is examined by focusing on differences in how typical and atypical problems are solved. Third, the effects of such reminding-based learning in everyday problem solving is examined to extend the findings and test some theoretical ideas that are difficult to investigate in more formal domains. GRA

**N92-11635#** Dayton Univ., OH.  
**LESSONS LEARNED IN THE DEVELOPMENT OF THE C-130 AIRCREW TRAINING SYSTEM: A SUMMARY OF AIR FORCE ON-SITE EXPERIENCE Final Report, Jan. 1990 - Mar. 1991**  
RON DUKES, MARTY R. ROCKWAY, and ROBERT T. NULLMEYER Aug. 1991 47 p  
(Contract F33615-90-C-0005)  
(AD-A240554; AL-TP-1991-0032) Avail: NTIS HC/MF A03  
CSCL 05/9

The current trend within the Air Force is to design aircrew training programs as total integrated systems. This trend has been

coupled with a concurrent shift to contracting out the design, delivery and support of aircrew training. These changes have introduced a new set of technical and management issues which impact the design, acquisition, and operation of aircrew training programs. The Aircrew Training Research Division of the Armstrong Laboratory is conducting research and development (R and D) to address several of these issues in order to provide principles, procedures, and user-oriented guidelines to support Air Force acquisition and operational training agencies. This paper is one of a series concerned with the identification of lessons learned by contractor and government personnel directly involved in the acquisition and utilization of contracted aircrew training systems (ATSS). It documents some of the major experiences and lessons learned by Lt Col Ron Dukes of the Military Airlift Command during his long involvement with the C-130 ATS program. The report provides a general description of the C-130 ATS program and summaries Lt Col Dukes' experiences and lessons learned in the areas of courseware, training management, test and evaluation, quality assurance, and configuration management. GRA

**N92-11636#** Air Force Human Resources Lab., Brooks AFB, TX.

**COGNITIVE FACTORS INVOLVED IN THE FIRST STAGE OF PROGRAMMING SKILL ACQUISITION Interim Technical Paper, Mar. 1989 - Mar. 1991**

CARMEN M. PENA and WILLIAM C. TIRRE Jul. 1991 27 p  
(AD-A240566; AL-TP-1991-0018) Avail: NTIS HC/MF A03  
CSCL 05/8

This study examined the role of cognitive abilities in the first stage of programming skill acquisition. Three hundred and five Air Force recruits were given 1.5 hours of computer based instruction on PASCAL. They were also administered computer-based tests assessing working memory, general reasoning, programming related knowledge, and component skills underlying algebra word problem solving. Additional test scores reflecting verbal knowledge were available from personnel records. Structural equation modeling was used to test alternative models of PASCAL learning, general cognitive abilities, and algebra word problem solving. The factors resulting from these analyses were then interrelated using structural models. The results showed that a model of PASCAL learning reflecting declarative and procedural factors was not superior in fit to a single factor model. In the general cognitive abilities domain, a three-factor model positing separate working memory, reasoning, and verbal knowledge abilities provided a better fit to the data than a single factor (g) model. Three factors were found to underlie algebra word problem solution. In interrelating the three sets of factors, we found that word problem translation added to significant contributions from more general abilities such as general reasoning, working memory, and verbal knowledge in predicting success in programming skill acquisition. GRA

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### MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

**A92-10334**  
**CORNEAL LENS GOGGLES AND VISUAL SPACE PERCEPTION**

ITZHAK HADANI (Rutgers University, New Brunswick, NJ) Applied Optics (ISSN 0003-6935), vol. 30, Oct. 1, 1991, p. 4136-4147. Research supported by Ministry of Science of Israel and Varo, Inc. refs  
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The corneal lens goggles (CLG) design is presented which brings the effective center of perspective of the goggles to coincide with the center of perspective of the eyes, thus annulling the

optical strength of the device. Comparative performance tests between the CLG and conventional goggles AN/PVS-5 revealed that the CLG showed better visual and visual-motor performance.

O.G.

#### A92-11126

**HUMAN FACTORS SOCIETY, ANNUAL MEETING, 34TH, ORLANDO, FL, OCT. 8-12, 1990, PROCEEDINGS. VOLS. 1 & 2** Santa Monica, CA, Human Factors Society, 1990, p. Vol. 1, 835 p.; vol. 2, 822 p. For individual items see A92-11127 to A92-11208.

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Current research on human factors in the areas of aerospace systems, aging, communications, computer systems, consumer products, education, environmental design, forensics professional, and industrial ergonomics is examined. Particular attention is given to displays and controls; situational awareness; workloads; human factors of teleoperation in space; aging and everyday activities; age-related slowing of performance; the design of communication systems; modeling of computer systems; rapid prototyping on graphics workstations; knowledge acquisition/expert systems; input devices; human-computer interaction; head movement, gestures, and speech input; human factors in consumer products; methods and evaluation of human factors instruction; environmental-design interventions; lower back biomechanics; manual material handling; human force exertion; and CTS and hand-wrist biomechanics.

O.G.

#### A92-11127

##### **EYE AND HEAD RESPONSE AS INDICATORS OF ATTENTION CUE EFFECTIVENESS**

GLORIA L. CALHOUN (USAF, Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) and WILLIAM P. JANSON (Logicon Technical Services, Inc., Dayton, OH) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 1. Santa Monica, CA, Human Factors Society, 1990, p. 1-5. refs (Contract F33615-85-C-0541)

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This study examined whether eye and head responses can be used to evaluate attention cue effectiveness. The subjects' tasks were to complete a centrally-located tracking task while periodically responding to cues to identify targets at four peripheral locations. Five directional cues were evaluated: visual symbol, coded sound, speech cue, three dimensional (3-D) sound and 3-D speech (the 3-D cues appeared to emanate from the peripheral locations). The results showed significant performance differences in eye and head reaction time, as well as peripheral target task completion time, as a function of cue modality. Since these relatively nonobtrusive measures were as sensitive to cue modality as the peripheral task completion time, these results suggest that eye and head reaction time can be used in evaluations addressing the effectiveness of attention cues.

Author

#### A92-11128

##### **EVALUATION OF A DIRECTIONAL AUDIO DISPLAY SYNTHESIZER**

GERMAN VALENCIA (USAF, Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) and JEFFREY R. AGNEW (MacAulay-Brown, Inc., Dayton, OH) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 1. Santa Monica, CA, Human Factors Society, 1990, p. 6-10. refs (Contract F33615-87-C-0534)

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A three-dimensional (3-D) auditory display imposes directionality to audio signals, over headphones, so that they are perceived as originating from unique spatial locations outside the listener's head. This study evaluated subjects' localization performance with a Directional Auditory Display (DIRAD) synthesizer. Subjects' ability to perceive the direction of target sounds in the azimuth plane was measured as a function of head movement with four types of audio stimuli. Results showed significant localization performance

differences as a function of sound location, head movement condition and stimulus type. These results help to define the functional requirements of a 3-D auditory display prior to the integration of synthesized directional audio into flight simulators and advanced aircrew systems.

Author

#### A92-11129

##### **ICONS VS. ALPHANUMERICS IN PILOT-VEHICLE INTERFACES**

MONICA J. CAMACHO, BRUCE A. STEINER, and BARRY L. BERSON (Lockheed Aeronautical Systems Co., Burbank, CA) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 1. Santa Monica, CA, Human Factors Society, 1990, p. 11-15. refs

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The effects on performance from the use of icons and alphanumeric in pilot-vehicle interfaces were investigated in an experiment. Varying numbers of single status display indicators were presented in both iconic and alphanumeric formats in fixed and random display positions across three levels of difficulty. Subjects' ability to maintain a tracking task while concurrently searching and selecting appropriate display indicators was tested. Results indicated that for all numbers of indicators presented, icons produced faster search and selection reaction times. Significant interactions were also found for format type and difficulty level. Questionnaire assessment revealed that subjects preferred the iconic to the alphanumeric formats. Implications for the design of aircraft interfaces and further research suggestions are discussed.

Author

#### A92-11130

##### **THE RELATIVE EFFECTIVENESS OF THREE VISUAL DEPTH CUES IN A DYNAMIC AIR SITUATION DISPLAY**

KIM M. MAZUR and JOHN M. REISING (USAF, Cockpit Integration Directorate, Wright-Patterson AFB, OH) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 1. Santa Monica, CA, Human Factors Society, 1990, p. 16-20. refs

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The purpose of this study was to evaluate the effectiveness of three visual depth cues, and combinations of these cues, in a dynamic air situation display. The study was conducted to help determine how best to display aircraft location to a pilot. Three different depth cues (stereo 3-D, aerial perspective, and familiar object size), were investigated. Additionally, two levels of display density (13 or 25 aircraft) were evaluated. The results of the study indicated that the number of depth cues, which ranged from zero to three, affected the subject's ability to determine aircraft location. Display density also affected performance. However, the particular type of depth cue did not have a differential effect. In other words, it makes a difference if one or two depth cues are displayed, but not the particular cues used.

Author

#### A92-11131

##### **COGNITIVE QUALITY AND SITUATIONAL AWARENESS WITH ADVANCED AIRCRAFT ATTITUDE DISPLAYS**

R. M. TAYLOR and S. J. SELCON (RAF, Institute of Aviation Medicine, Farnborough, England) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 1. Santa Monica, CA, Human Factors Society, 1990, p. 26-30. refs

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Highly agile combat aircraft create demanding requirements for the cognitive quality of aircraft attitude information. Evidence is presented on aircrew decision-making performance on simulated attitude recovery tasks requiring situational awareness with different types of attitude representation. Pictorial aircraft 'outside-looking-in' attitude representations appear to require cognitive rotation prior to response selection. A pictorial Command Indicator (CI), with only small attitude deflections, generated relatively low processing demands, without increasing situational awareness. A contact analog Attitude Indicator (AI) representation was superior to relatively less familiar Head-Up Display (HUD) pitch scale, even

when switching attention between references. The supremacy of AIs is attributed to the greater accessibility and compatibility of appropriate 'inside-looking-out' cognitive schemata. HUD representations create relatively low understanding of situations, but appropriate schemata may become more accessible with HUD training. Author

**A92-11132****AN EVALUATION OF THE AUGIE ARROW HUD SYMBOLOGY AS AN AID TO RECOVERY FROM UNUSUAL ATTITUDES**

JOHN E. DEATON, MICHAEL BARNES (U.S. Navy, Naval Air Development Center, Warminster, PA), JONATHAN KERN, and DOUGLAS WRIGHT (VEDA, Inc., Warminster, PA) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 1. Santa Monica, CA, Human Factors Society, 1990, p. 31-35. refs  
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The degree of spatial awareness obtained using what has been called an Augie Arrow (Newman, 1987) is examined. It was enabled so that it could be displayed as either a nearest horizon pointer (NH) or an up arrow (UP) indicator. Particular attention is given to the usefulness of analog dials vice digital readouts of airspeed and altitude as an aid to recovery. During a simulated flight, 12 subjects were required to recover from 6 unusual attitudes employing one of the 4 HUD formats standard HUD, Augie Arrow, analog dials, and Augie Arrow with analog dials. Results showed that the Augie Arrow produced the most rapid recovery time and was optimal at the most severe unusual attitudes, especially for the NH mechanization. O.G.

**A92-11133****THE USE OF 3-D STEREO DISPLAY OF TACTICAL INFORMATION**

BRUCE A. STEINER and DIANE A. DOTSON (Lockheed Aeronautical Systems Co., Burbank, CA) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 1. Santa Monica, CA, Human Factors Society, 1990, p. 36-40. refs  
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This study examined the effects of adding 3-D stereoscopic altitude information to a standard aircraft tactical situation display. In an experiment, displays presenting varying number of hostile aircraft were presented to subjects in either a 2-D or 3-D format via a computer driven real time simulation system. Tests indicate, that for all levels of number of threats, the 2-D displays resulted in faster response times and fewer errors to locate particular classes of targets. Questionnaire and interview results, however, showed that subjects prefer the use of 3-D displays, and felt that their use gave them a competitive edge over their opponents. Implication for the use of this technology in aircraft heads down displays, as well as suggestions for further research are discussed. Author

**A92-11134****PREDICTIVE UTILITY OF AN OBJECTIVE MEASURE OF SITUATION AWARENESS**

MICA R. ENDSLEY (Texas Tech University, Lubbock) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 1. Santa Monica, CA, Human Factors Society, 1990, p. 41-45. refs  
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A situation awareness global assessment technique (SAGAT) was developed and validated as an objective measure of a pilot's situation awareness (SA). A relationship between the SA and the performance was investigated through SAGAT. The utility of SA in a manned fighter sweep tactical mission was evaluated using experienced pilot subjects. Results showed that the pilots were only able to utilize good SA to achieve good performance when allowed to do so by the rules of engagement, when they had the aircraft and weapons capabilities to take an advantage of that knowledge, and when they made the right tactical decisions based on their SA. O.G.

**A92-11135****DECISION SUPPORT IN THE COCKPIT - PROBABLY A GOOD THING?**

STEPHEN J. SELCON (RAF, Institute of Aviation Medicine, Farnborough, England) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 1. Santa Monica, CA, Human Factors Society, 1990, p. 46-50. refs  
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Use of expert decision support systems in the context of the military fast-jet aircraft is considered with particular attention given to the electronic crewmember or pilot associate concept. The approach presented provides explicit, system-generated probability estimates at the interface to reduce the uncertainty associated with the decision. It was found that the provision of probability values, which clearly distinguished between decision options, reduced decision latencies and increased subjective confidence, without interfering with memory for relevant details of the decision. Probability values with very small absolute differences between options increased the decision times. O.G.

**A92-11136****TARGETING DECISIONS USING MULTIPLE IMAGING SENSORS - OPERATOR PERFORMANCE AND CALIBRATION**

SCOTT A. WEISGERBER and MARION P. KIBBE (U.S. Navy, Naval Weapons Center, China Lake, CA) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 1. Santa Monica, CA, Human Factors Society, 1990, p. 56-60. refs  
(Contract NAVY PROJECT RS34H20)  
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Experiments on target identification performance and operator calibration using sensor imagery from a single information source or two sources are described. Relative to the single-sensor condition, performance in the dual-sensor condition was either enhanced or degraded depending on the quality of the information presented on each sensor. Operator calibration was found to be poor, with operators consistently underestimating the accuracy of their target identification performance. O.G.

**A92-11137****THE EFFECTS OF SCENE COMPLEXITY ON JUDGEMENTS OF AIMPOINT DURING FINAL APPROACH**

WOODROW BARFIELD and CRAIG ROSENBERG (Washington, University, Seattle) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 1. Santa Monica, CA, Human Factors Society, 1990, p. 61-65. refs  
(Contract NSF DMC-88-57851)  
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To study the effect of scene complexity on the performance of a final approach task, different animations representing combinations of scene complexity and distance interval to threshold were modeled. The results indicate that there is a significant interaction between scene complexity and distance to the actual impact point for both horizontal and vertical components of the judgment task. Increasing the level of terrain complexity leads to better performance in judgments of horizontal displacement. The results for vertical displacements are found to be unclear. O.G.

**A92-11142\*** Illinois Univ., Savoy.**MAP DISPLAY DESIGN**

ANTHONY J. ARETZ (Illinois, University, Savoy) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 1. Santa Monica, CA, Human Factors Society, 1990, p. 89-93. refs  
(Contract NAG2-308)  
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This paper presents a cognitive model of a pilot's navigation task and describes an experiment comparing a visual momentum map display to the traditional track-up and north-up approaches. The data show the advantage to a track-up map is its congruence with the ego-centered forward view; however, the development of survey knowledge is hindered by the inconsistency of the rotating display. The stable alignment of a north-up map aids the acquisition

of survey knowledge, but there is a cost associated with the mental rotation of the display to a track-up alignment for ego-centered tasks. The results also show that visual momentum can be used to reduce the mental rotation costs of a north-up display. Author

#### A92-11143

##### AIRBORNE EARLY WARNING AND COLOR-CODING

G. L. RICARD (Grumman Aircraft Systems, Bethpage, NY) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 1. Santa Monica, CA, Human Factors Society, 1990, p. 94-98. refs  
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Improvements to airborne early warning possible by color-coding information into the current surveillance radar system of the E-2C aircraft are examined. Man-in-the-loop simulation was used to examine performance in a taxing but realistic war-alert scenario. A number of measures of operator performance showed differences between color and monochrome operation. Results revealed that operators remained more aware of the tactical situation, organized better defenses of their task force, and reduced threats to the fleet better with the color-coded display. O.G.

#### A92-11144

##### COLOR CODING AND SIZE ENHANCEMENTS OF SWITCH SYMBOL CRITICAL FEATURES

KRISTEN K. BARTHELEMY, KIM M. MAZUR, and JOHN M. REISING (USAF, Cockpit Integration Directorate, Wright-Patterson AFB, OH) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 1. Santa Monica, CA, Human Factors Society, 1990, p. 99-103. refs  
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Consideration is given to two studies aimed at evaluating recognition performance of signals on programmable switches using different critical feature enhancement techniques. In the first study, the size enhancement was between 60-75 percent in total number of pixels for the critical feature. The amount of size enhancement was limited by the display surface area. In the second study, a new method of size enhancement was utilized whereby the longest axis of the critical feature was increased by 0.10 of an inch. In this study there was no display surface constraint. The results of the first study indicate that only the color coding technique is significant. In the second study, both color coding and size enhancement are significant. It is concluded that in the first study the way in which the size enhancement was applied to the critical feature (an increase in total surface area) was not sufficient to achieve a unique symbol, thus it did not improve subject recognition ability. In the second study, size enhancing was sufficient to result in a performance payoff. O.G.

#### A92-11146

##### CLASSIFICATION OF FLIGHT SEGMENT USING PILOT AND WSO PHYSIOLOGICAL DATA

GLENN F. WILSON and FRANK FISHER (USAF, Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 1. Santa Monica, CA, Human Factors Society, 1990, p. 109-111. refs  
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Discriminant analysis with physiological data was used to evaluate mission/design effects and to provide for on-line monitoring of operator state. Eight flight segments for nineteen crew members were classified using heart rate and eye blink data as variables. Results show that, for the pilots, 93 percent of the flight segments were correctly classified and for WSOs 89 percent were correctly classified. It is concluded that combined cardiac and eye blink data produced better classifications than when each was used alone. O.G.

#### A92-11148

##### HUMAN FACTORS OF TELEOPERATION IN SPACE

THOMAS J. SMITH (Minnesota, University, Minneapolis) and MARK A. STUART (Lockheed Engineering and Sciences Co., Houston, TX) IN: Human Factors Society, Annual Meeting, 34th, Orlando,

FL, Oct. 8-12, 1990, Proceedings. Vol. 1. Santa Monica, CA, Human Factors Society, 1990, p. 116-120. refs  
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A symposium aimed at profiling the human factors which may be expected to critically influence human performance with telerobotic systems in space environments is summarized. Results of human factors and human performance research reveal three major categories influencing task performance variability in teleoperation, including task-specific design, interface design, and behavioral performance factors. It is concluded that teleoperation performance is profoundly degraded by spatial and temporal perturbations in visual feedback. O.G.

A92-11149\* Lockheed Engineering and Sciences Co., Houston, TX.

##### HAND CONTROLLER COMMONALITY EVALUATION PROCESS

MARK A. STUART, JOHN M. BIERSCWALE, ROBERT P. WILMINGTON, SUSAN C. ADAM, MANUEL F. DIAZ (Lockheed Engineering and Sciences Co., Houston, TX), and DEAN G. JENSEN (NASA, Johnson Space Center, Houston, TX) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 1. Santa Monica, CA, Human Factors Society, 1990, p. 121-125. refs  
(Contract NAS9-17900)  
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A hand controller evaluation process has been developed to determine the appropriate hand controller configurations for supporting remotely controlled devices. These devices include remote manipulator systems (RMS), dexterous robots, and remotely-piloted free flyers. Standard interfaces were developed to evaluate six different hand controllers in three test facilities including dynamic computer simulations, kinematic computer simulations, and physical simulations. The hand controllers under consideration were six degree-of-freedom (DOF) position and rate minimaster and joystick controllers, and three-DOF rate controllers. Task performance data, subjective comments, and anthropometric data obtained during tests were used for controller configuration recommendations to the SSF Program. O.G.

#### A92-11150

##### FITTS' TASK BY TELEOPERATOR - MOVEMENT TIME, VELOCITY, AND ACCELERATION

JOHN V. DRAPER, STEPHEN HANDEL, and CHRISTOPHER C. HOOD (Human Machine Interfaces, Inc., Knoxville, TN) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 1. Santa Monica, CA, Human Factors Society, 1990, p. 127-131. refs  
(Contract DE-AC05-86ER-80403)  
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Experiments on teleoperation with replica master controllers are reported. In the first experiment subjects completed Fitts' (1954) reciprocal tapping task by hand and with a teleoperator. Movement time and index of difficulty were linearly related in these data. It is found that times were much longer with the teleoperator than when participants completed the task by hand. The information rate for the teleoperator was 2.88 bits/sec, and for performance by hand it was 16.98 bits/sec. In the second experiment master handle velocity and acceleration were calculated for each 10-millisecond interval during tapping task trials. Most velocity observations (95 percent) made during the task terminal phase were less than 0.45 m/sec. The low-variability group exhibited accelerations between -0.9 and 0.9 m/sec squared. The high variability group exhibited accelerations ranging from -29 to 41 m/sec squared. O.G.

#### A92-11152

##### A COGNITIVE MODELING TECHNIQUE FOR COMPLEX DECISION STRATEGIES

JANINE A. PURCELL (Massachusetts, University, Amherst) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 1. Santa Monica, CA, Human Factors

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Society, 1990, p. 254-258. refs  
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A cognitive modeling technique based on the GOMS model of Card, Moran, and Newell (1983) was used to analyze the composition and structure of decision-making strategies in a multidimensional diagnostic task. It was found that certain strategies predominated according to visual display format. The methodology represents an interesting approach to the analysis of verbal and retrospective protocol data solicited in conjunction with complex decision-making tasks. O.G.

### A92-11155

#### TARGET SIZE, LOCATION, SAMPLING POINT AND INSTRUCTIONAL SET - MORE EFFECTS ON TOUCH PANEL OPERATION

DENNIS B. BERINGER (New Mexico State University, Las Cruces) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 1. Santa Monica, CA, Human Factors Society, 1990, p. 375-379. refs  
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To examine the effects of target position and size upon accuracy of the touch input, a screening experiment using a central-composite design (CCD) has been conducted. Results suggest that an error for right-handed users is least near the resting position of the hand (lower right corner of display) and that shortest response times could also be obtained there. It is also found that, although instructions requiring higher precision of input from the operator do not substantially affect bias error, they do produce a reduction in variable error. It is recommended that, for applications having established key input areas, positions along the lower and right-hand borders of the control/display unit should be used to minimize activation time and error. O.G.

### A92-11156\*

#### Ohio State Univ., Columbus. NAVIGATING THROUGH LARGE DISPLAY NETWORKS IN DYNAMIC CONTROL APPLICATIONS

DAVID D. WOODS (Ohio State University, Columbus), EMILIE M. ROTH, WILLIAM F. STUBLER, and RANDALL J. MUMAW (Westinghouse Science and Technology Center, Pittsburgh, PA) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 1. Santa Monica, CA, Human Factors Society, 1990, p. 396-399. Research supported by NASA and Westinghouse Electric Corp. refs  
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Special display navigation challenges in computer-based display systems for monitoring and controlling dynamic processes are reviewed. Particular attention is given to trends in information technology, workspace design, and paradigmatic cognitive functions related to display navigation. O.G.

### A92-11158

#### THE IMPACT OF ICONS AND VISUAL EFFECTS ON LEARNING COMPUTER DATABASES

DAVID H. MERWIN, BRIAN P. DYRE, DARRYL G. HUMPHREY, JOHN GRIMES, and JOHN F. LARISH (Illinois, University, Urbana) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 1. Santa Monica, CA, Human Factors Society, 1990, p. 424-428. refs  
Copyright

The impact of icons and visual effects on item selection time and recall of hierarchical database structure was examined. It was found that both the type of representation (icon-text vs. text alone) and the type of transition between menus (zoom instantaneous change or dissolve) affect subjects' ability to recall the structure of the database. It is suggested that icons and visual effects can facilitate recall of hierarchical databases without increasing traversal time. O.G.

### A92-11159

#### DESIGNING HABITATS TO SUPPORT LONG-DURATION ISOLATION AND CONFINEMENT

JACK STUSTER (Anacapa Sciences, Inc., Santa Barbara, CA) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct.

8-12, 1990, Proceedings. Vol. 1. Santa Monica, CA, Human Factors Society, 1990, p. 557-561. refs  
Copyright

This presentation summarizes research conducted to identify and evaluate the features of a designed environment that contribute to habitability. Habitability is defined and discussed in terms of 13 dimensions relevant to conditions in which human crew live and work in isolation and confinement. Design suggestions are presented to enhance human performance and productivity, and a research program is described that has led to significant habitability improvements in isolated and confined military environments. Author

### A92-11161

#### LOW COST, REAL TIME SIMULATION BASED ON MICROCOMPUTERS

R. W. ALLEN, JEFFREY R. HOGUE, ANTHONY C. STEIN, BIMAL L. APONSO, and THEODORE J. ROSENTHAL (Systems Technology, Inc., Hawthorne, CA) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 1. Santa Monica, CA, Human Factors Society, 1990, p. 640-644. refs  
Copyright

This paper describes a general approach for implementing fixed base, person-in-the-loop, vehicle control simulations on IBM-PC compatible computers. The elements of fixed base (no motion) simulations are reviewed, including the vehicle math model, auditory and visual displays, and performance measurement. Two simulation examples are discussed, including a highway vehicle control task and a parachute maneuvering task. Author

### A92-11162

#### ACTIVITY AND COOPERATION IN A MULTI-PERSON TELEOPERATOR COCKPIT

CHRISTOPHER C. HOOD, JOHN V. DRAPER, and STEPHEN HANDEL (Human Machine Interfaces, Inc., Knoxville, TN) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 1. Santa Monica, CA, Human Factors Society, 1990, p. 660-663. refs  
(Contract DE-AC05-86ER-80403)  
Copyright

This experiment attempted to determine how members of a teleoperator crew use equipment and interact when performing remote maintenance tasks. The experiment used a modified process analysis technique to record how users performed two typical remote maintenance tasks. Five people participated in the experiment. They were paired into teams representing several experience levels. Participants completed the tasks while two television cameras recorded their actions on videotape. Observers later scored the video tapes using the process analysis chart. The percent of time each participant spent engaged in each activity was calculated, as was the percent of time the participants cooperated and co-acted in the cockpit. This information will be helpful in designing future teleoperator cockpits and other related control rooms. Author

### A92-11163

#### THE EVOLUTIONARY ROLE OF HUMANS IN THE HUMAN-ROBOT SYSTEM

THOMAS M. GRANDA, MARK KIRKPATRICK, TRACYE D. JULIEN (Carlow Associates, Inc., Fairfax, VA), and LARRY A. PETERSON (U.S. Army, Human Engineering Laboratory, Aberdeen, MD) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 1. Santa Monica, CA, Human Factors Society, 1990, p. 664-668. refs  
Copyright

Stages of human-robot capability were identified and criticalities of certain generic human operator functions were estimated for the capability stages. The resulting profile defines the changing role of the human operator throughout development of the capability changes. The results can be applied to human factors research and development in the human-robot systems area. O.G.

A92-11164

**AN ANTHROPOMETRIC EVALUATION OF THE TH-57 JETRANGER HELICOPTER**

ROBERT C. CHAPLESKI and EDWARD D. ADRIAN (Louisiana State University, Baton Rouge) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 1. Santa Monica, CA, Human Factors Society, 1990, p. 710-714. refs

Copyright

Results of a questionnaire and field study evaluating the TH-57 Jetranger helicopter are summarized. The questionnaire was distributed among student pilots asking their opinions on the operation of the helicopter. The problem with a cramped cockpit environment, obstructed visibility, difficulties in reaching and even seeing some instruments and gages, and several comfortability factors were revealed. The field test indicated that this helicopter is deficient in accommodating individuals within the allowable anthropometric ranges for student pilots. O.G.

A92-11175\* Ohio State Univ., Columbus.

**A TESTBED FOR THE EVALUATION OF COMPUTER AIDS FOR ENROUTE FLIGHT PATH PLANNING**

PHILIP J. SMITH, CHUCK LAYTON, DEB GALDES (Ohio State University, Columbus), and C. E. MCCOY (San Jose State University, CA) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 2. Santa Monica, CA, Human Factors Society, 1990, p. 1095. Research supported by FAA.

(Contract NCC2-165)

Copyright

A simulator study of the five airline flight crews engaged in various enroute planning activities has been conducted. Based on a cognitive task analysis of this data, a flight planning workstation has been developed on a Mac II controlling three color monitors. This workstation is being used to study design concepts to support the flight planning activities of dispatchers and flight crews in part-task simulators. Author

A92-11176

**WORKSTATION DESIGN FOR ATC SYSTEMS**

RUSSELL A. BENEL and LOUIS M. ADAMS (IBM Corp., Systems Integration Div., Rockville, MD) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 2. Santa Monica, CA, Human Factors Society, 1990, p. 1108-1112. Research supported by FAA.

(Contract DTFA01-84-C-00039; DTFA01-88-C-00042)

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Developing a workstation for the next generation ATC system (AAS) represents a significant design challenge. Not only are a large number of potentially conflicting requirements identified for this workstation, but several unique features of those requirements exacerbate the potential problems. The system must accommodate a large range of user sizes and be acceptable to approximately 16,000 air traffic controllers. A team of controllers has participated in the iterative design effort through reviews, demonstrations and hands-on evaluation. The key feature of all design activities is the narrowing of alternatives as the design approaches production release. This paper addresses this process and suggests how this process may be managed to ensure a satisfactory outcome. Author

A92-11179

**A PROGRAM TO STUDY HUMAN FACTORS IN AIRCRAFT MAINTENANCE AND INSPECTION**

WILLIAM T. SHEPHERD (FAA, Office of Aviation Medicine, Washington, DC) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 2. Santa Monica, CA, Human Factors Society, 1990, p. 1168-1170.

Copyright

The maintenance and inspection of civil aircraft with respect to human factors is the subject of a research program designed to analyze job training and performance, critical task elements, and error occurrence. The parameters of inspection conditions

are considered including knowledge, attitudes, work conditions, and technology. On-site study and analysis are employed with an error-classification system to identify error-related factors and develop corresponding training and work-environment improvements. C.C.S.

A92-11182

**TASK ANALYSIS OF AIRCRAFT INSPECTION ACTIVITIES - METHODS AND FINDINGS**

COLIN G. DRURY, P. PRABHU, and A. GRAMOPADHYE (New York, State University, Buffalo) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 2. Santa Monica, CA, Human Factors Society, 1990, p. 1181-1185. Research supported by FAA. refs

Copyright

To provide baseline data on the present inspection activities of commercial aircraft, a task analysis of inspection by commercial carriers was initiated as part of the FAA's National Ageing Aircraft Research Program. The task analysis methodology developed, typical results, and some human-system mismatches detected are described. Attention to this project focuses on the maintenance sites of major national/international carriers and the methods applied during maintenance inspections. R.E.P.

A92-11184

**GUIDE FOR HUMAN PERFORMANCE MEASUREMENTS**

VALERIE J. GAWRON (Calspan Corp., Buffalo, NY), LEONARD CIPRIANO (Lockheed Engineering and Science Co., Moffett Field, CA), EDWIN FLEISHMAN (George Mason University, Fairfax, VA), FRED HEGGE (Walter Reed Army Institute of Research, Washington, DC), ED LEHMAN (Veda, Inc., Dayton, OH), JOHN REISING (USAF, Wright Research and Development Center, Dayton, OH), and DAVID MEISTER IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 2. Santa Monica, CA, Human Factors Society, 1990, p. 1238-1240.

Copyright

A set of guidelines is described which addresses methods for human-performance measurement (HPM), allows database transfer without reformatting, and can be used to develop models of human performance. The guidelines encompass HPM techniques that have been successfully employed and permit the comparison of studies on HPM that follow procedures outlined therein. The guide is considered to be of general use to such fields as applied research and system design as well as evaluations of task performance and risk. C.C.S.

A92-11188

**DEVELOPMENT OF AUTOMATIC PROCESSING WITH ALPHANUMERIC MATERIALS**

F. T. EGGEMEIER, ANDREA B. GRANITZ, TIMOTHY E. ROGUS, and ERIC E. GEISELMAN (Dayton, University, OH) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 2. Santa Monica, CA, Human Factors Society, 1990, p. 1357-1361. refs

(Contract F33615-88-C-0015)

Copyright

The development of automatic processing with alphanumeric materials that are representative of those processed by operators of some complex information systems is investigated. The effects of 3200 training trials in a memory search paradigm are compared with alphanumeric materials under consistently mapped (CM) and variably mapped conditions. Dissimilar target and distractor sets were used. The results are consistent with the development of automatic processing in CM conditions. The effect of similar target and distractor sets on CM performance is examined. The results indicate that target/distractor similarity significantly affects CM performance. It is concluded that such similarity is an important factor to be considered in the design of training programs to support the development of automatic processing with complex alphanumeric materials. C.A.B.



A92-11193

**HUMAN FACTORS CONSIDERATIONS IN THE DESIGN OF DISPLAYS AND SWITCHES FOR A FLIGHT SIMULATOR'S ONBOARD INSTRUCTOR/OPERATOR STATION (IOS)**

THOMAS L. SEAMSTER (Carlow Associates, Inc., Fairfax, VA) and RICHARD H. GLASS (Hughes Simulation Systems, Inc., Herndon, VA) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 2. Santa Monica, CA, Human Factors Society, 1990, p. 1400-1404. refs  
Copyright

The MV-22A training device suite Operational Flight Trainer (OFT) and Aircrew System Trainer (AST) specification requirements provide for an instructor work environment that focuses on integrating the instructor's position with the training environment. This paper will describe the process to refine a display/switch design dedicated to over-the-shoulder instruction at the IOS. The time frame encompasses the period from the mockup through the IOS-specific design reviews which addresses a mature IOS display/switch design. This new IOS display/switch design mirrors the aircraft's Multi-Function Displays (MFDs) which provide the pilots rapid and efficient access to aircraft systems and environmental data, while allowing for primary focus on flying the aircraft. Correspondingly, the IOS display/switch design for control and monitor of the training scenario, allows the instructor to focus on trainee actions, the aircraft instrument panel, and the visual system's forward field of view. Author

A92-11194

**PHYSIOLOGICAL AND SUBJECTIVE EVALUATION OF A NEW AIRCRAFT DISPLAY**

GLENN F. WILSON, EDWARD HUGHES, and JOHN HASSOUN (USAF, Wright-Patterson AFB, OH) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 2. Santa Monica, CA, Human Factors Society, 1990, p. 1441-1443. refs  
Copyright

Physiological, subjective, and mission effectiveness measures were evaluated to test their relative sensitivity and diagnosticity to pilot workload in a part-mission simulation. Two different radar displays were evaluated in an air-to-air simulated scenario using an advanced horizontal situation format display vs the conventional radar display. Data were recorded during the ingress and engagement portions of the mission. The engagement segments were associated with higher subjective workload estimates, smaller cardiac IBIs, fewer eye blinks, and shorter duration eye blinks. The new display was associated with shorter duration eye blinks than the current generation display. None of the other measures were associated with statistically significant changes due to display type. Author

A92-11195\* National Aeronautics and Space Administration, Ames Research Center, Moffett Field, CA.

**SYMBOLIC ENHANCEMENT OF PERSPECTIVE DISPLAYS**

STEPHEN R. ELLIS and SELIM S. HACISALIHZADE (NASA, Ames Research Center, Moffett Field, CA) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 2. Santa Monica, CA, Human Factors Society, 1990, p. 1465-1469. refs  
Copyright

Two exocentric azimuth judgment experiments with a perspective display were conducted with 16 subjects. Previous work has shown these judgments to exhibit a bias possibly due to misinterpretation of the viewing parameters used to generate the display. Though geometric compensations may be used to correct for the bias, an alternate technique selected in the following 2 experiments was the introduction of symbolic enhancements in the form of compass roses. It is suggested that a compass rose with 30 deg divisions results in overall optimal azimuth estimation accuracy when accuracy and decision time are both considered. The data also suggest that the added radial lines on the compass roses may interact with normalization processes that influence the judgment errors. Author

A92-11196

**VISUAL ENHANCEMENTS AND GEOMETRIC FIELD OF VIEW AS FACTORS IN THE DESIGN OF A THREE-DIMENSIONAL PERSPECTIVE DISPLAY**

WOODROW BARFIELD, RAFAEL LIM, and CRAIG ROSENBERG (Washington, University, Seattle) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 2. Santa Monica, CA, Human Factors Society, 1990, p. 1470-1473. refs  
(Contract NSF DMC-85-7851)  
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This study investigated the effect of providing visual enhancements to a three-dimensional (3D) perspective display on the observers ability to judge the azimuth and elevation which separated two computer-generated images. The 3D perspective scenes were modeled after displays presented previously by McGreevy and Ellis (1986) but with several visual enhancements designed to assist users in performance of the experiment tasks. The visual enhancements included: (1) the capability to rotate the perspective scenes in near real-time and, (2) the presentation of solid shaded objects in the computer-generated scenes. The results provide information on the magnitude of the errors which occur when observers are required to make directional judgments using perspective displays and on the effectiveness of several visual enhancements on the accuracy of directional judgments using a 3D perspective display. Author

A92-11197

**THREE DIMENSIONAL DISPLAY TECHNOLOGY FOR AEROSPACE AND VISUALIZATION**

CHRISTOPHER D. WICKENS and STEVEN TODD (Illinois, University, Savoy) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 2. Santa Monica, CA, Human Factors Society, 1990, p. 1479-1483. refs  
Copyright

The similarities and contrast between scientific visualization, and the tasks imposed on the pilot and air traffic controller are highlighted. Relevant principles for 3 dimensional display design for both of these applications are stated, and an experiment is described which contrasts four graphical formats across a number of tasks involving the interpretation of a hypothetical set of scientific data. The tasks vary in the degree to which focused attention vs integration is involved. The graphical formats were either 2 or 3D renderings and either did or did not contain contours to emphasize objectness. The results revealed that emergent features, created either by objectness or 3 dimensionality, facilitated integration performance. However, 3 dimensionality generally slowed performance on all tasks. Author

A92-11198

**RESOURCE ALLOCATION AND OBJECT DISPLAYS**

PAMELA S. TSANG and WILLIAM E. BATES (Wright State University, Dayton, OH) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 2. Santa Monica, CA, Human Factors Society, 1990, p. 1484-1488. Research supported by Wright State University. refs  
Copyright

A study focusing on development of a more in depth understanding of the attention mechanisms involved in object perception is described. Multidimensional information was presented in the form of an object that was defined by its form, color and size. As predicted by Kahneman and Treisman's object file model, results show that all dimensions of the object appeared to be processed, as evidenced by the influence of the irrelevant size variation on form and color identification. R.E.P.

A92-11203

**INFORMATION REPRESENTATIONS FOR AIRCRAFT ATTITUDE DISPLAYS**

ROBERT K. OSGOOD and MICHAEL VENTURINO (USAF, Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 2.

Santa Monica, CA, Human Factors Society, 1990, p. 1542-1546. refs

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Several attitude displays are examined with respect to the effects of the displays and their associated visual features on the performance of a simulated unusual attitude-recovery task. Both conventional and unconventional display types are employed in the study to convey the 'real-world' information required for maintaining controlled flight. The subjects performed a tracking task followed by the attitude-recovery task, and RMS error and time-to-recovery are calculated. Data relating to six measured parameters are subjected to a multivariate analysis, and the results suggest that the control errors and initial reversals suggest consistent differences between displays. A wide-angle virtual umbrella leads to more accurate responses than the head-up displays, a fact attributed to stimulation of the fovea and peripheral retina as well as the perspective grid acting as a mimetic cue.

C.C.S.

#### A92-11204

##### EFFECTS OF VARIATIONS IN HEAD-UP DISPLAY AIRSPEED AND ALTITUDE REPRESENTATIONS ON BASIC FLIGHT PERFORMANCE

WILLIAM R. ERCOLINE (Krug Life Sciences, Brooks AFB, TX) and KENT K. GILLINGHAM (USAF, School of Aerospace Medicine, Brooks AFB, TX) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 2. Santa Monica, CA, Human Factors Society, 1990, p. 1547-1551. refs

Copyright

Five different HUD altitude and airspeed symbol sets are examined for efficacy in a basic instrument crosscheck during visually simulated flight. Altitude and airspeed were varied during the flight profile, requiring the pilots to recognize deviations and correct back to target conditions. Rms performance errors (deviations from assigned altitude and airspeed) were measured. The pilots' altitude and airspeed control was significantly better with two new formats, rotating pointers with dot scales and plain rotating pointers, than with two more common formats, boxed digits and moving vertical tapes.

R.E.P.

#### A92-11206

##### THE EFFECTS OF TRANSIENT ADAPTATION ON COCKPIT OPERATIONS

EDWARD J. RINALDUCCI, DONALD L. LASSITER, and LAWRENCE MITCHELL (Central Florida University, Orlando, FL) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 2. Santa Monica, CA, Human Factors Society, 1990, p. 1562-1566. refs

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Two experiments examined visibility loss as a function of sudden changes in luminance level such as those that might be experienced by a pilot in a high-performance aircraft. Luminance levels chosen were similar to those found at dawn and dusk or under nighttime conditions. In the first experiment, the observer was required to recognize test letters varying in spectral composition similar to what might be seen on a HUD. The large background field changed upwards or downwards a one- or two-log unit increment. Results indicated losses for both directions of change. No differences were found between the different test-letter colors. In the second experiment, the observer was exposed to changing background fields which were presented from 0 to 5 degrees from foveal fixation. In general, results indicated greater effects for background stimuli closest to central fixation and decreasing to zero with increasing eccentricity.

Author

#### A92-11207\*

##### FIELD OF VIEW EFFECTS ON A SIMULATED FLIGHT TASK WITH HEAD-DOWN AND HEAD-UP SENSOR IMAGERY DISPLAYS

MICHAEL S. BRICKNER (Pamam Human Factors Engineering, Ltd., Ramat-Hasharon, Israel) and DAVID C. FOYLE (NASA, Ames Research Center, Moffett Field, CA) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings.

Vol. 2. Santa Monica, CA, Human Factors Society, 1990, p. 1567-1571. refs

Copyright

Field-of-view (FOV) effects are investigated in simulated flights with sensor imagery appearing on a head-up display (HUD) and a head-down display (HDD). The pilots fly a simulated slalom course and are given information from a sensor image with a 25-, 40-, or 50-deg FOV and no additional information. The factors which most significantly affect performance are thereby identified, and the speed of flying, level of training, and FOV are found to be the most important characteristics. FOV affects performance regardless of the choice of HUD or HDD, and the narrow FOV caused the pilots to fly closer to the obstacles than the wider FOVs. No statistically significant difference between the use of HUD and HDD is identified, but the pilots appear to regard the displays in general as the entire world and not as a 'window on the world'.

C.C.S.

#### A92-11208

##### HEAD MOVEMENTS AS A FUNCTION OF FIELD-OF-VIEW SIZE ON A HELMET-MOUNTED DISPLAY

MICHAEL VENTURINO (USAF, Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) and MAXWELL J. WELLS (Logicon Technical Services, Inc., Dayton, OH) IN: Human Factors Society, Annual Meeting, 34th, Orlando, FL, Oct. 8-12, 1990, Proceedings. Vol. 2. Santa Monica, CA, Human Factors Society, 1990, p. 1572-1576. refs

Copyright

Measurements were made of subjects' head movements as they found and memorized the position of targets located around them. Four factors were manipulated: the size of the field-of-view (FOV) with which they could view the targets, the number of targets, the background against which the targets were presented (blank or terrain), and the search instructions (slow or fast). The targets and terrain were viewed on a binocular helmet-mounted display. The dependent variables included measures of the amount of head displacement and head velocity. In the slow search trials, small FOVs produced significantly more head displacement and lower head velocities than did the large FOVs. In the fast search trials, head velocity increased with increasing FOV. The results are interpreted in terms of the disruptive effects of small FOVs on the efficient use of coordinated head and eye movements to acquire spatial information.

Author

#### A92-12306

##### A 16-CHANNEL 8-PARAMETER WAVEFORM ELECTROTACTILE STIMULATION SYSTEM

KURT A. KACZMAREK, KEVIN M. KRAMER, JOHN G. WEBSTER, and ROBERT G. RADWIN (Wisconsin, University, Madison) IEEE Transactions on Biomedical Engineering (ISSN 0018-9294), vol. 38, Oct. 1991, p. 933-943. refs

(Contract NIH-NS-26328)

Copyright

A general-purpose electro tactile (electrocutaneous) stimulation system has been developed as a research tool for studying psychophysiological performance associated with various stimulation waveforms. An experimenter-defined command file specifies the stimulation current and waveform of each of the 16 channels. The system provides a burst onset delay of 0-20 ms, a phase current of 0-50 mA, an interphase interval of 0-1000 microsecs, 1-100 pulses per burst, a pulse repetition rate of 0.1-25 kHz, a phase width of 2-1000 microsecs, and functionally monophasic pulses (with zero dc current) or balanced-biphasic pulses (with equal positive and negative phases). The system automatically delivers the desired stimulation, prompts the subject for responses, and then logs subject responses. Key features of the system are (1) the very flexible choice of bursts of pulsatile waveforms, (2) the real-time control of all of the waveform parameters as mathematical functions of external analog inputs, and (3) the high-performance electrode-driver circuitry.

I.E.



**A92-12333\*** Washington Univ., Seattle.

## PERFORMANCE EVALUATION OF A SIX-AXIS GENERALIZED FORCE-REFLECTING TELEOPERATOR

BLAKE HANNAFORD (Washington University, Seattle), LAURIE WOOD (Texas University, Austin), DOUGLAS A. MCAFFEE, and HAYA ZAK (JPL, Pasadena, CA) IEEE Transactions on Systems, Man, and Cybernetics (ISSN 0018-9472), vol. 21, May-June 1991, p. 620-633. Previously announced in STAR as N90-13796. refs Copyright

Work in real-time distributed computation and control has culminated in a prototype force-reflecting telemanipulation system having a dissimilar master (cable-driven force-reflecting hand controller) and a slave (PUMA 560 robot with custom controller), an extremely high sampling rate (1000 Hz), and a low loop computation delay (5 msec). In a series of experiments with this system and five trained test operators covering more than 100 hours of teleoperation, performance was measured in a series of generic and application-driven tasks with and without force feedback, and with control shared between teleoperation and local sensor referenced control. All performance measures improved as capability was added along a spectrum of capabilities ranging from pure position control through force-reflecting teleoperation and shared control. Performance was optimal for the bare-handed operator.

Author

**A92-12427**

**IN-ORBIT EXPERIMENT OF OBJECT CAPTURE TECHNOLOGY**  
W. PRENDIN, A. TERRIBILE, and D. MADDALENA (Tecnomare S.p.A., Venice, Italy) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 9 p. Research supported by EEC, Istituto Mobiliare Italiano, ASI, et al. refs (IAF PAPER 91-002) Copyright

Results of the definition study of an in-orbit robotic experiment proposed for utilization within the technology demonstration program of the ESA are presented. The experiment focuses on testing the capability of capturing free-flying objects by employing an automatic tracking technique originally developed for underwater applications in the offshore industry. Consideration is given to the possibility of transferring this technology to space applications.

R.E.P.

**A92-12447\*** Rensselaer Polytechnic Inst., Troy, NY.

## DETERMINATION OF THE CRITICAL PARAMETERS FOR REMOTE MICROSCOPE CONTROL

R. C. HAHN, B. A. HERBACH (Rensselaer Polytechnic Institute, Troy, NY), J. C. JOHNSTON, and M. BETHEA (NASA, Lewis Research Center, Cleveland, OH) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 6 p. (Contract NAG3-1065)

(IAF PAPER 91-026) Copyright

A remote-controlled microscope has been designed as part of a program to determine the capacities of telescience as applied to microgravity materials science. The hardware involves a microscope with positioning device, motors on the zoom and focus controls, a mounted standard TV camera, and computer control of the devices and output. Tests show that the focus setting can be established well within the resolution limit of the TV system, that each motion takes about 50 sec, and that about 12 min are required to reach 'best' focus.

C.D.

**A92-12448**

## SUPERVISED SPACE ROBOTIC SYSTEM - OPERATOR INTERFACE DESIGN

PIOTR WOJCIK, PATRICK FEIGHAN, and KEITH CHRYSTALL (Alberta Research Council, Advanced Computing and Engineering Dept., Calgary, Canada) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 10 p. refs (IAF PAPER 91-027) Copyright

The conceptual design of an operator interface for a teleoperated robotic system is presented. This concept addresses the problems of information and command transmission time delays by using predictive simulations of robot activities. It is shown that

the predictive simulation enables a human operator to preview performance of robots before a work plan is executed by the robotic system in orbit.

R.E.P.

**A92-12454\*** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

## HUMAN EXPLORATION AND SETTLEMENT OF MARS - THE ROLES OF HUMANS AND ROBOTS

MICHAEL B. DUKE (NASA, Johnson Space Center, Houston, TX) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 10 p. refs (IAF PAPER 91-035) Copyright

The scientific objectives and strategies for human settlement on Mars are examined in the context of the Space Exploration Initiative (SEI). An integrated strategy for humans and robots in the exploration and settlement of Mars is examined. Such an effort would feature robotic, telerobotic, and human-supervised robotic phases.

C.D.

**A92-12455**

## SIMULATION OF A PLANETARY HABITATION SYSTEM ADAPTED TO THE MARTIAN SURFACE

Y. E. VIERTEL (Stuttgart, Universitaet, Federal Republic of Germany) and U. APEL (MBB-ERNO, Bremen, Federal Republic of Germany) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 11 p. refs (IAF PAPER 91-036) Copyright

A model of a manned planetary base on the Martian surface for long-term missions is developed. Special consideration is given to the simulation of an environmental control and life support system based on the utilization of local resources. The model is used for a parametrical analysis and optimization of two reference missions. The simulations prove that the recycling is the most profitable option, especially for water, with the losses of water to be replaced by extraction from local resources.

I.S.

**A92-12469**

## CONTROL SYSTEM ARCHITECTURE OF THE MOBILE SERVICING SYSTEM

MICHAEL E. STIEBER, DANTE A. LAURENZIO (Canadian Space Agency, Ottawa, Canada), and PATRICK T. K. FUNG (Spar Aerospace, Ltd., Toronto, Canada) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 8 p. refs (IAF PAPER 91-055) Copyright

The design of the Canadian Mobile Servicing System (MSS) for the Space Station Freedom is described. Special attention is given to the Space Station Remote Manipulator System, a larger of the two robotic systems designed for massive payloads; the Special Purpose Manipulator, a robot for tasks that require dexterous manipulation of small objects such as Orbital Replaceable Units; and the functions and control architecture of the MSS control system. A diagram of the MSS is presented.

I.S.

**A92-12470**

## DEVELOPMENT OF FLYING TELEROBOT MODEL FOR GROUND EXPERIMENTS

YOSHITSUGU TODA, TOSHIKI IWATA, KAZUO MACHIDA (Electrotechnical Laboratory, Tsukuba, Japan), AKIKO OTSUKA, HIDETOSHI TORIU, and YASUO SHINOMIYA (Toshiba Corp., Komukai Works, Kawasaki, Japan) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 9 p. refs (IAF PAPER 91-056) Copyright

A space telerobot model for ground experiments is presently operable for free flying and manipulating on a 2D flat test bed with an air bearing system. A method is proposed for cooperative control between the robot body's attitude control and the manipulator position control that indicates adequate performance. The manipulator force control methods, e.g., impedance control and the active limp, are very effective while capturing and handling a floating object in a microgravity field.

R.E.P.

**A92-12475****ROBOTIC VISION TECHNOLOGY FOR SPACE STATION AND SATELLITE APPLICATIONS**

A. K. C. WONG, D. N. C. TSE, G. R. HEPPLER (Waterloo, University, Canada), and K. RUEB (Virtek Corp., Waterloo, Canada) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 15 p. refs (IAF PAPER 91-061) Copyright

Robotic vision technologies newly developed for satellites and Space Station applications are presented. The utilization of stereo CCD camera for sensing the deformed shape of a third generation satellite is described. Attention is given to the notion of shape interpolation and error reduction. R.E.P.

**A92-12483****ON THE DESIGN AND DEVELOPMENT OF THE SPACE STATION REMOTE MANIPULATOR SYSTEM (SSRMS)**

R. G. DANIELL (Spar Aerospace, Ltd., Weston, Canada) and J. R. BECK (Canadian Space Agency, Ottawa, Canada) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 12 p. (IAF PAPER 91-074) Copyright

The significant design features of the SSRMS and details of the several new mechanical designs being developed for the SSRMS are presented. Design requirements must permit remotely controlled relocation of the SSRMS to various operating points on the Station and provide the capability using robotics and/or EVA, to maintain and repair the SSRMS while on-orbit. Attention is given to the latching end effector, the collet latch, the power and data grapple fixture, the force moment sensor, and the joint motor modules. R.E.P.

**A92-12484****THE SPACE STATION REMOTE MANIPULATOR SYSTEM, HUMAN COMPUTER INTERFACE CONSIDERATIONS**

GILLES PELLETIER (CAE Electronics, Ltd., Saint-Laurent, Canada) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 9 p. Research supported by Canadian Space Agency. (IAF PAPER 91-075) Copyright

NASA's Space Station Freedom (SSF) will incorporate the Space Station Remote Manipulator System (SSRMS). The interface between the SSRMS and its human operator must compensate for the preclusion of direct vision by distances and obstacles. Operator reaction time is presently identified as a major factor in the design of this human-computer interface; operator-reaction delays will be minimized through the use of real-time animated graphics that are overlaid on the SSRMS's video images. Accounts are presently given of the SSRMS's display of measured and computed parameters, command modes, input techniques, and interactions between user and computer. O.C.

**A92-12499****SPDM ROBOT/ASTRONAUT COMPARISONS WITH RESPECT TO SPACE STATION FREEDOM OPERATIONS**

D. L. BROWN and L. R. STEVENS (Spar Aerospace, Ltd., Toronto, Canada) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 12 p. refs (IAF PAPER 91-093) Copyright

Assembly and maintenance operations for NASA's Space Station Freedom (SSF) will be performed either by EVA or by teleoperated extravehicular robotics. The Mobile Servicing System (MSS) supplied by Canada for the SSF employs two robotic manipulators: the Space Station Remote Manipulator System and the Special Purpose Dexterous Manipulator (SPDM). A comparative study is presently conducted for the EVA and SPDM approaches of the MSS during SSF assembly and maintenance. Attention is given to the illustrative case of a Design Reference Mission for the self-maintainability of the MSS. O.C.

**A92-12503****TV OPERATION CAPABILITIES AND RECOMMENDATIONS FOR THE NEXT DECADES**

A. FLOETE (MBB-ERNO, Bremen, Federal Republic of Germany) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 11 p. refs (IAF PAPER 91-098) Copyright

A review is presented of the emerging capabilities of computer animated video scenes. The advantages of the proposed use of video simulation are described along with the logical and technical frontiers of such systems. It is indicated that the implementation of 3D objects in a realistic environment prior to the real hardware becoming available, can provide the operator with an early and precise definition of system and payload operations. R.E.P.

**A92-12505\***

National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.

**SPACE STATION FREEDOM PAYLOAD OPERATIONS IN THE 21ST CENTURY**

C. S. GRINER and S. R. NONEMAN (NASA, Marshall Space Flight Center, Huntsville, AL) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 8 p. (IAF PAPER 91-101) Copyright

The modified approach to the accommodation of payload operations in light of both flight and ground systems changes to the operational concept for the Space Station Freedom is described. The challenges for the man-tended capability payload operations and those for the permanently manned capability are assessed. An overview of payload operations is presented including payload accommodations, operations modes, ground systems, the payload operations integration center, and the evolution from man-tended capability to permanent manning. R.E.P.

**A92-12510\***

National Aeronautics and Space Administration, Washington, DC.

**TECHNOLOGY FOR INCREASED HUMAN PRODUCTIVITY AND SAFETY ON ORBIT**

JUDITH AMBRUS (NASA, Office of Aeronautics, Exploration, and Technology, Washington, DC) and CHARLES F. GARTRELL (General Research Corp., Vienna, VA) IAF, International Astronautical Congress, 42nd, Montreal, Canada, Oct. 5-11, 1991. 14 p. refs

(IAF PAPER 91-107) Copyright

Technologies are addressed that can facilitate the efficient performance of station operations on the Space Station Freedom (SSF) and thereby optimize the utilization of SSF for scientific research. The dedication of SSF capabilities to scientific study and to the payload-user community is a key goal of the program. Robotics applications are discussed in terms of automating the processing of experiment materials on-orbit by transferring ampules to a furnace system or by handling plant-tissue cultures. Noncontact temperature measurement and medical support technology are considered important technologies for maximizing time for scientific purposes. Detailed examinations are conducted of other technologies including advanced data systems and furnace designs. The addition of the listed technologies can provide an environment in which scientific research is more efficient and accurate. C.C.S.

**N92-10287\*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

**DISPLAY FORMAT, HIGHLIGHT VALIDITY, AND HIGHLIGHT METHOD: THEIR EFFECTS ON SEARCH PERFORMANCE**

KIMBERLY A. DONNER, TIM D. MCKAY, KEVIN M. OBRIEN (Lockheed Engineering and Sciences Co., Houston, TX.), and MARIANNE RUDISILL Oct. 1991 15 p (NASA-TM-104742; S-654; NAS 1.15:104742) Avail: NTIS HC/MF A03 CSCL 05/8

Display format and highlight validity were shown to affect visual display search performance; however, these studies were conducted on small, artificial displays of alphanumeric stimuli. A study manipulating these variables was conducted using realistic, complex Space Shuttle information displays. A 2x2x3 within-subjects analysis of variance found that search times were faster for items in reformatted displays than for current displays. Responses to valid applications of highlight were significantly faster

than responses to non or invalidly highlighted applications. The significant format by highlight validity interaction showed that there was little difference in response time to both current and reformatted displays when the highlight validity was applied; however, under the non or invalid highlight conditions, search times were faster with reformatted displays. A separate within-subject analysis of variance of display format, highlight validity, and several highlight methods did not reveal a main effect of highlight method. In addition, observed display search times were compared to search time predicted by Tullis' Display Analysis Program. Benefits of highlighting and reformatting displays to enhance search and the necessity to consider highlight validity and format characteristics in tandem for predicting search performance are discussed.

Author

**N92-10288#** Army Research Inst. of Environmental Medicine, Natick, MA.

**A COMPUTER SIMULATION FOR PREDICTING THE TIME COURSE OF THERMAL AND CARDIOVASCULAR RESPONSES TO VARIOUS COMBINATIONS OF HEAT STRESS, CLOTHING, AND EXERCISE**

KENNETH K. KRANING, II Jun. 1991 54 p  
(AD-A240023; USARIEM-T13-91) Avail: NTIS HC/MF A04  
CSCL 06/10

This report describes a new computer simulation of human temperature regulation for predicting limiting physiological responses to work under heat stress. Possible military applications include adjustment of work: rest cycles during intermittent work in protective clothing or confined spaces and determining optimal recovery periods and environments following exercise and/or exposure to hot environments. Using data bases from 7 independent studies of widely varying workload and environment, the simulation was validated by comparing the standard deviations (sd) of variable means (internal temperature, skin temperature and heart rate) in the data sets with the root mean squared deviations (rmsd) between the variable means and the corresponding simulator outputs. Results suggest that, on the average and within the range of data tested, the present simulation is able to forecast results with the same order of precision as laboratory studies of the same problems. Future applications could include incorporation into on-line expert systems used as tactical decision aids and as a tool to aid the experimental design of studies on the competing stresses of work, heat, dehydration, sleep deprivation and chemical protective drugs.

GRA

**N92-11049\*#** Computer Technology Associates, Inc., Rockville, MD.

**HUMAN FACTORS ISSUES IN THE DESIGN OF USER INTERFACES FOR PLANNING AND SCHEDULING**

ELIZABETH D. MURPHY /in NASA. Goddard Space Flight Center, Space Network Control Conference on Resource Allocation Concepts and Approaches p 135-144 Sep. 1991  
Avail: NTIS HC/MF A13 CSCL 05/8

The purpose is to provide an overview of human factors issues that impact the effectiveness of user interfaces to automated scheduling tools. The following methods are employed: (1) a survey of planning and scheduling tools; (2) the identification and analysis of human factors issues; (3) the development of design guidelines based on human factors literature; and (4) the generation of display concepts to illustrate guidelines.

Author

**N92-11051\*#** Computer Technology Associates, Inc., Rockville, MD.

**CHIMES-2: A TOOL FOR AUTOMATED HCI ANALYSIS**

WILLIAM J. WEILAND /in NASA. Goddard Space Flight Center, Space Network Control Conference on Resource Allocation Concepts and Approaches p 159-166 Sep. 1991  
Avail: NTIS HC/MF A13 CSCL 05/8

The topics are presented in view graph form and include the following: Computer Human Interaction Models (CHIMES) methodology; the CHIMES-2 prototype; and CHIMES future development.

Author

**N92-11637\*#** Vanderbilt Univ., Nashville, TN. Dept. of Electrical Engineering.

**ROBOT GRAPHIC SIMULATION TESTBED Final Report**

GEORGE E. COOK, JANOS SZTIPANOVITS, CSABA BIEGL, GABOR KARSAI, and JAMES F. SPRINGFIELD Aug. 1991  
119 p Original contains color illustrations  
(Contract NAG8-690)  
(NASA-CR-188998; NAS 1.26:188998) Avail: NTIS HC/MF A06;  
12 functional color pages CSCL 06/11

The objective of this research was twofold. First, the basic capabilities of ROBOSIM (graphical simulation system) were improved and extended by taking advantage of advanced graphic workstation technology and artificial intelligence programming techniques. Second, the scope of the graphic simulation testbed was extended to include general problems of Space Station automation. Hardware support for 3-D graphics and high processing performance make high resolution solid modeling, collision detection, and simulation of structural dynamics computationally feasible. The Space Station is a complex system with many interacting subsystems. Design and testing of automation concepts demand modeling of the affected processes, their interactions, and that of the proposed control systems. The automation testbed was designed to facilitate studies in Space Station automation concepts.

Author

**N92-11638\*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

**HUMAN MACHINE INTERFACES FOR TELEOPERATORS AND VIRTUAL ENVIRONMENTS CONFERENCE**

Mar. 1990 175 p Conference held in Santa Barbara, CA, 4-9 Mar. 1990  
(NASA-CP-10071; NAS 1.55:10071; AD-A240716) Avail: NTIS  
HC/MF A08 CSCL 05/8

In a teleoperator system the human operator senses, moves within, and operates upon a remote or hazardous environment by means of a slave mechanism (a mechanism often referred to as a teleoperator). In a virtual environment system the interactive human machine interface is retained but the slave mechanism and its environment are replaced by a computer simulation. Video is replaced by computer graphics. The auditory and force sensations imparted to the human operator are similarly computer generated. In contrast to a teleoperator system, where the purpose is to extend the operator's sensorimotor system in a manner that facilitates exploration and manipulation of the physical environment, in a virtual environment system, the purpose is to train, inform, alter, or study the human operator to modify the state of the computer and the information environment. A major application in which the human operator is the target is that of flight simulation. Although flight simulators have been around for more than a decade, they had little impact outside aviation presumably because the application was so specialized and so expensive.

GRA

**N92-11639\*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

**LUNAR RADIATOR SHADE Patent Application**

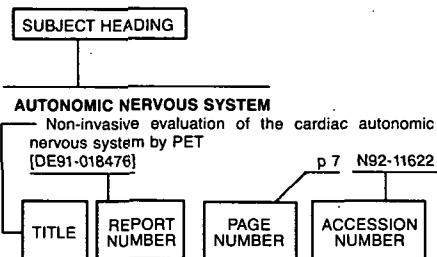
MICHAEL K. EWERT, inventor (to NASA) 25 Sep. 1991 13 p  
(NASA-CASE-MS-C-21868-1; NAS 1.71:MSC-21868-1;  
US-PATENT-APPL-SN-765273) Avail: NTIS HC/MF A03 CSCL  
06/11

An apparatus for rejecting waste heat from a system located on or near the lunar equator which utilizes a reflective catenary shaped trough deployed about a vertical radiator to shade the radiator from heat (i.e., infrared radiation) emitted by the hot lunar surface. The catenary shaped trough is constructed from a film material and is aligned relative to the sun so that incoming solar energy is focused to a line just above the vertical radiator and thereby isolate the radiator from the effects of direct sunlight. The film is in a collapsed position between side by side support rods, all of which are in a transport case. To deploy the film and support rods, a set of parallel tracks running perpendicular to length of the support rods are extended out from the transport case. After the support tracks are deployed, the support rods are positioned equidistant from each other along the length of the support tracks.

so that the flexible film shade between adjacent support rods is unfolded and hangs in a catenary shaped trough. A heat radiator is supported between each pair of support rods above each hanging reflective trough.

NASA

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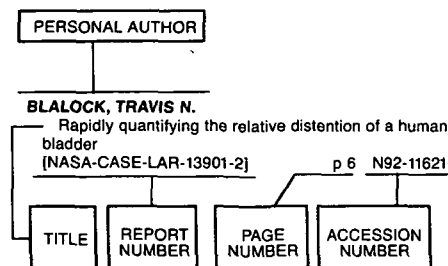
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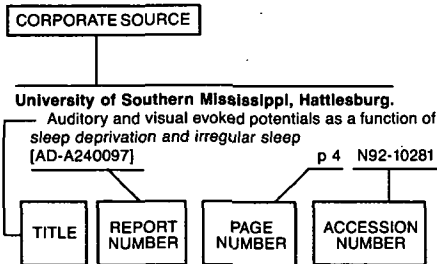
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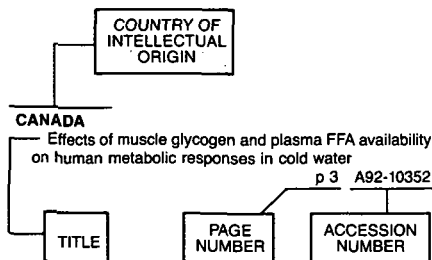
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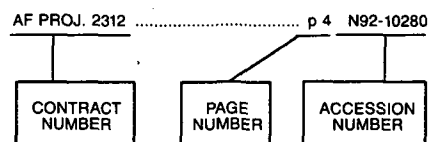


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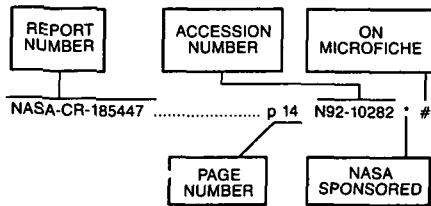
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February 1992

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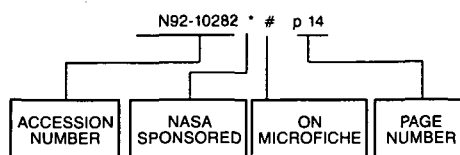
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